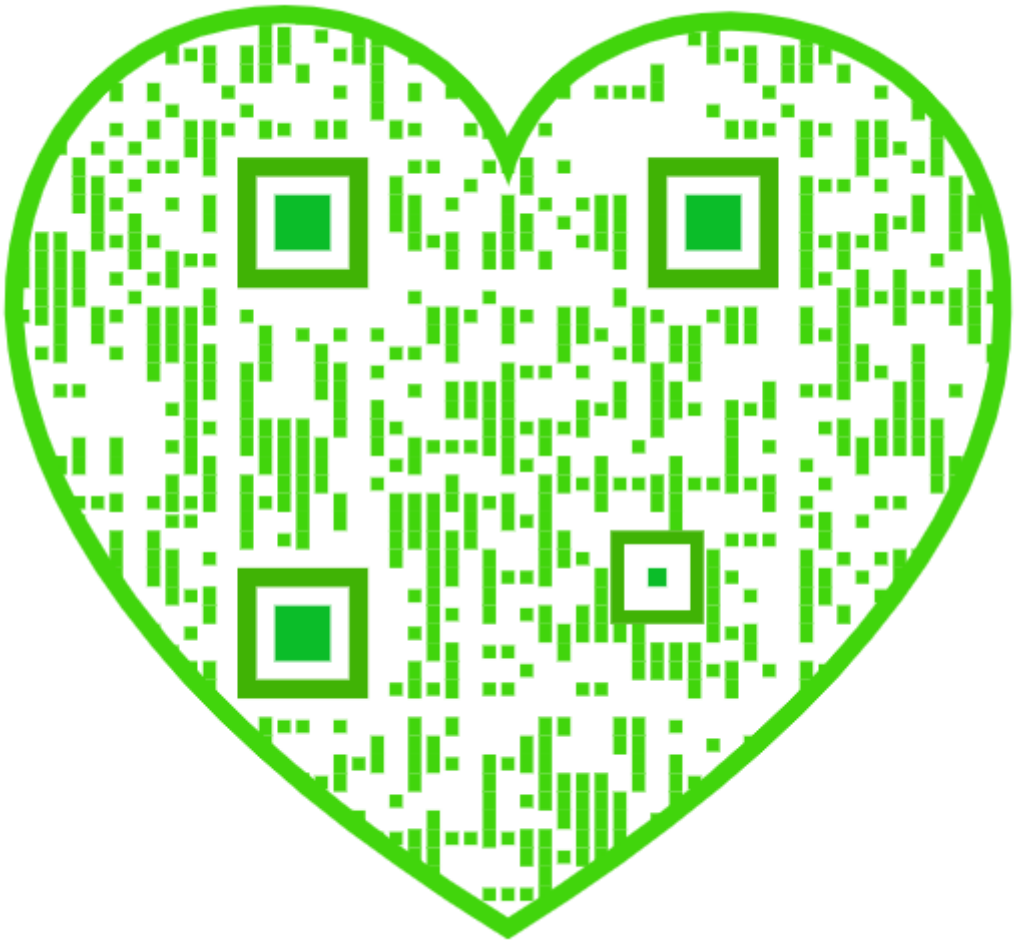

# THE ELECTRIC THEORY

OF

# ASTRONOMY.

BY

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AUTHOR OF

"NOTES OF A WESTERN RAMBLER, OR SIXTY YEARS' PIONEER LIFE IN THE WEST;" "THE GREAT CENTRAL VALLEY OF NORTH AMERICA, CONSIDERED WITH REFERENCE TO ITS TOPOGRAPHY, HYDROLOGY, MINERALOGY, ANTIQUITIES," ETC.

WITH AN INTRODUCTION

BY

REV. R. H. RIVERS, A. M., D. D.

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# PREFACE.

THIS work has been in the course of preparation for over fifty years.

The elementary principles on which it is based were first brought to the notice of the author in the Summer of 1834 by Judge John Richardson, a native of New York, then living in Crawford County, Illinois.

He satisfactorily accounted for the revolution of the earth on its axis by the attractive and the repulsive forces of electricity proceeding from the sun, but he had made no farther progress in the development of the whole theory upon which the electric system of astronomy is based.

Beginning from this initial point, the author has occupied his leisure hours in applying the principles of electric attraction and repul-

sion as a motor power, and has found that from these causes all the motions of the heavenly bodies could be accounted for in a manner far more rational and philosophic than by the existing system of astronomy.

In 1867, while residing in Chapel Hill, Texas, by request of the faculty of Soule College, the theory was for the first time presented to the public, in a course of lectures before the faculty and students of that institution.

In 1878 the same lectures were repeated by request before the Lyceum of Houston, Texas, when, at the suggestion of leading members of that body, they were prepared for the press in four lectures and brought out in pamphlet form.

Having a strong desire more fully to test the validity and correctness of the principles involved, the author determined to make a tour through Texas and other Western States, and deliver a course of lectures before the faculty and students of different colleges,

thereby to elicit the objections and to call forth the criticisms of the most learned on the correctness of the doctrines presented.

Some of the institutions visited were the State College at Bryan, the Baptist University at Waco, and the Female Colleges at Sherman and Paris, in Texas. At Louisville, Ky., the faculty and students of the male and female high schools assembled for the purpose of hearing my lectures in the Male Institute, where a large number of scientific men, by invitation, were present. I subsequently lectured at the Kentucky Wesleyan College, at Millersburg, Ky.

On all these occasions eminent educators responded in most favorable terms, expressing their gratification at being favored with the presentation of a new system of astronomy based upon electric principles. Though they could not be asked, at so early a day, to indorse the doctrines presented, they regarded the system as worthy the closest investigation.

The results of this test experiment were entirely satisfactory to the author. The criticisms and remarks elicited were valuable in impressing upon his mind the necessity of a wider range, to take in all the facts and principles connected with the system.

For example, the structure and functions of the sun, as the great center whence dynamic electricity is derived, were more perfectly studied.

It was manifest that the expenditures of the sun must be sustained by an ample and compensating supply of dormant or static electricity, and if this were true, then the sun must be capacitated not only to emit, but also to receive supplies. This naturally suggested that there must be apertures or open mouths through which the supplying currents could pass into the solar body. When we looked to the sun with this inquiry in mind, we found it fully answered, as shown in our chapters on the sun. This and other discoveries were made during this lecture tour.

On arriving at Cincinnati, finding the first edition of a thousand copies of my pamphlet about exhausted, three additional lectures were prepared, and a new edition, incorporating all the improvements then made, was published January, 1879.

In August, 1882, having made two additional discoveries, I negotiated with A. Wilford Hall, Ph. D., editor of the *Literary Microcosm*, New York, for publishing in his magazine a series of articles entitled "Electricity, the Motor Power of the Solar System."

Up to this period the forces by which the earth is propelled in its orbit around the sun had not been satisfactorily discovered, nor the elliptic form of the earth's orbit, and the inclination of its axis to the plane of its orbit, been demonstrated to be an electric necessity.

To incorporate these and other new features not only gave further perfection to the system, but its publication in a magazine of the high order and wide circulation of the *Microcosm* was a more convenient mode of

bringing the theory before the public than its direct presentation in personal lectures.

During the process of the publication, through a whole volume of the *Microcosm*, my theory was brought in contact with the minds of a very large number of acute and able scientists in all parts of the United States and Europe. This drew upon me a correspondence of a very extensive and interesting character, which enabled me to form some estimate of the manner in which my patient and long-continued labors were received by the scientific public.

In the various forms in which my views have been presented they have now been before the public eighteen years. Through the latter medium, the circulation, as stated, has been very extensive, and up to this date the author has been gratified to find that no formal and decided stand has as yet been taken against the fundamental principles on which the theory is based; but, on the contrary, a more hearty indorsement and more encourag-

ing expressions of approval have been received than could reasonably have been expected in regard to a system so diverse from the commonly received doctrines in regard to the sublime science of astronomy.

The prejudices of education are very great; so much so that it generally requires two or three generations to effect any great revolution in the public mind on subjects of this kind, and hence the author has ventured to present the results of his labor, with due deference to public sentiment, in this volume.

It is not claimed for this work that it is perfect in all its parts, but in the firm conviction that its principles are sound and in harmony with the laws of the universe, we hope it will not be thought presumptuous in one so obscure as the author to present this little volume to the calm and impartial consideration of a virtuous public.

If its perusal and a fair interpretation of its doctrines shall lead other and abler minds to the more perfect development of the all-

pervading forces of electric action, by which the inquiring world will be enlightened and benefited, this will be a sufficient compensation for the fifty years' thought spent in maturing the theory here presented.

The whole work has been carefully revised and greatly enlarged since its publication in the *Microcosm*, with new and original matter never before in print. Hence we are now prepared to submit it to a candid public, relying on its merits as its only vindication.

THE AUTHOR.

Mt. Sterling, Ky., January, 1886.

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# INTRODUCTION

—BY—

REV. R. H. RIVERS, A. M., D. D.

TRUTH is immortal and well-nigh omnipotent. It may be opposed by ignorance, resisted by prejudice, and rejected by human learning, and still it must at last prevail and be right regally crowned. Truth is harmony, and does not possess one quality which indicates that it can die.

The author of this book, and the originator of the theory of electricity the motor power of the solar system, has been guided throughout by his love for the truth. This new departure has not been made hurriedly, but after the closest investigation and the most laborious and painstaking examination of facts. His theory is founded upon facts, and in all respects conforms to facts.

He did not originate a theory and then seek to make facts, but the facts in nature forced the theory upon him. Modest and retiring, he was slow to believe himself the discoverer of a great scientific truth, which had been hidden from philosophers and scientists all along the ages.

Honest in his search after truth, and accurate in his observation of facts, he has all along invited criticism. When criticism has been made, he has met it with a fairness which shows his anxiety to know the whole truth. Self-poised and with a calm and quiet spirit, he has met and by stubborn facts has foiled all his antagonists.

Great discoverers of great truths have usually been unsuccessful in establishing the truth of their discoveries to the generation living at the time of such discoveries. Kepler said that he was willing to wait a hundred years for just one to appreciate what he had done for the cause of science. If time shall prove the correctness of the electric theory discussed in this book, the theory of universal gravitation, as taught by Newton and since his day, must yield to the power of truth. All the romance about the falling apple will disappear before the blaze of electric light. The doctrine of centripetal and centrifugal forces will be substituted by the much simpler one of electric attraction and repulsion. To the student of astronomy it has ever been a most difficult task to understand how it is that when a planet reaches its perihelion, when the attraction of the sun is the strongest, and of course the centripetal force the most powerful—how it is, we say, that at that very juncture the centrifugal

force comes on and saves the planet from falling into the sun. This difficulty is at once removed by the substitution of positive and negative electricity.

Bodies in like electrical conditions repel each other, and in opposite electrical conditions attract each other. When a planet is at its perihelion it becomes positively electrified by its nearness to the sun, and is repelled until it reaches its aphelion, when it loses its positive condition by its great distance from the source of electricity—the sun—and is again attracted. Truth is simple, and here it is seen in its native simplicity.

Again, it has always been a wonder how the heart could exert a physical force equal to two hundred and forty pounds to drive the blood through the circulatory system with the rapidity with which it is known to pass, and accomplish all this without rupturing the arteries and capillaries of the whole system. This difficulty is fully removed in the following treatise by the substitution of electric force for the driving force in the muscular power of the heart.

Another great merit of this book is that it opposes no established *fact*. All the facts of astronomy are admitted, and so with physiology, botany, etc., and upon these facts a theory startling in its

simplicity, its comprehensiveness, and its satisfactory conclusions is presented to thoughtful and impartial readers.

Patiently has the laborer toiled, and grandly has he succeeded. Neither himself nor the author of this brief introduction will live to see the wonderful changes which must result from discoveries which are sure to place his name alongside of the greatest discoverers the world has ever known. We ask a careful reading by minds all free from prejudice, and we fear not the result.

LOUISVILLE, KY., January, 1886.

THE

# ELECTRIC THEORY OF ASTRONOMY.

## Chapter I.

*BRIEF SKETCH OF THE HISTORY OF ASTRONOMY.*

THE science of astronomy, it is agreed on all hands, takes rank among the first in point of antiquity, and still holds the highest position in point of sublimity, of any that has been cultivated among enlightened men. Agriculture and architecture may claim to have an equal antiquity, but are inferior in grade.

The *American Cyclopædia* fixes the earliest date at which astronomic observations were made as early as 2250 years before Christ. It says: "We find in Ptolemy's 'Almagest' the records of observations of considerable accuracy made at Babylon at a very early epoch. Some of the observations which were trans-

mitted to Aristotle by Callisthenes were made about 2250 B. C." This date takes us back to the days of Nimrod, or to about the time of the confusion of tongues at Babel and the founding of the city of Babylon.

Astronomy was for many centuries so intimately associated with astrology and heathen mythology that many of the allusions made to the heavenly bodies indicate this connection. An example may be given from Job xxxviii, 31–35. Here God is represented as interrogating Job upon his wisdom and power: "Canst thou bind the sweet influences of Pleiades or loose the bands of Orion?" etc. Here it is evident that allusion is made to the astrological idea of the stars and constellations holding an influence over the earth, favorable or otherwise. "*Pleiades*"—the "*Seven Stars*"—appearing in the Spring, was supposed to exercise a "*sweet influence*" over the seasons, bringing forth foliage, flowers, and fruits; while Orion appeared in the Winter, and "*bound*" the earth in fetters of ice and snow. And so of other stars. The mythology of the ancients also deified most of the prominent stars, and worshiped them as gods, clothing

each with such attributes of character and power as imagination or fancy might dictate.

Encumbered with these fanciful and mysterious influences, the true science of astronomy labored through nearly four thousand years; for they had dominion over many nations long after the days of Copernicus.

It is believed by most of our best historians on this subject that the ancient Chaldean astronomers were in possession of a far more perfect system of astronomy than that taught by the Alexandrian school of Egypt many centuries after. It is believed that the Chaldeans held to the modern doctrine that the sun is the center of the solar system, and that the planets revolve around it; but when the great Alexandrian school, under the reign of the Ptolemies in Egypt, gained a controlling influence over the public mind, what has been called the Ptolemaic system was established about 200 B. C., and held dominion for more than seventeen hundred years. This system taught that the earth is the center of the solar system, and that the sun, moon, and stars revolve about it.

This was the condition of the science until

1473, when COPERNICUS was born in Prussia. His education was mostly received in Italy. On returning to Prussia he devoted himself mostly to the study of astronomy. Rejecting the Ptolemaic theory he was the first to decide: "The sun and stars are stationary; the moon alone revolves about the earth; the earth is a planet, whose orbit is between Venus and Mars; the planets revolve about the sun; and the apparent revolution of the heavens is caused by the earth's revolution on its axis."

Copernicus lived until May 24, 1543—seventy years—and died on the day his first book published on this subject was shown to him.

JOHANN KEPLER, the first noted disciple of Copernicus, was born in Prussia on the 27th of December, 1571, twenty-eight years and seven months after the death of Copernicus. He was sickly and frail in his youth, but graduated in the University of Tübingen in 1591. After devoting himself to teaching in several schools of high repute, he finally gave his chief attention to the study of astronomy under Mostlin, a student of Copernicus. In 1595 he published his first almanac based upon the Copernican theory. Kepler embraced the

doctrines of the Reformation under Luther, which were agitating the public mind in his day, and thereby subjected himself to severe persecution and the loss of his property, so that he labored under great pecuniary embarrassment in the prosecution of his labors.

In 1602 Kepler published a popular work called "Principles of Astronomy," in which he described "the power of certain harmonious configurations of suitable planets to control human impulses." Thus the early teachings of astrology are found to abide even in the mind of this great scientist. But, it is said, he only resorted to these lighter productions of his pen as a means of support while pursuing his legitimate labors for the advancement of true science.

In 1604 he was engaged in the study of the structure of the human eye and the laws of vision. He was successful during the same year in calculating eclipses. His work on this subject is still used.

In 1611 he discovered and published his three laws of motion, which are still regarded as true. The elliptic form of the orbit of Mars was discovered by Kepler, and, by anal-

ogy, it is concluded that the orbits of all the planets take the same form.

Between 1618 and 1622 appeared the seven books of his "Epitome of the Copernican Astronomy," which was placed by the Inquisition on the list of prohibited books; and in 1619 he published his "Harmony of the World," dedicated to James I of England. Kepler died in Ratisbon, November 15, 1630, aged fifty-nine years.

GALILEO, the distinguished philosopher and mathematician, a contemporary with Kepler, was born in Pisa, Italy, February 15, 1564. Though Galileo was the senior of Kepler by seven years, yet he came upon the field of action in the great battle fought over the reformation in astronomic science at a later date than Kepler, and continued his labors until 1642, twelve years after the death of Kepler.

The history of the eventful life of this heroic champion for scientific truth is lengthy, and hence we can only notice such parts of it as fall within the line of the history of astronomy. The crowning glory of his life was the invention of the telescope and the vast field of

discoveries brought to light by that instrument.

In 1593 Galileo became a convert to the Copernican theory, and had an intimate correspondence with Kepler on the subject. "In 1609 a report reached him at Venice that a Dutchman had constructed an instrument which had the property of making distant objects seem near." On hearing this "he immediately applied himself to the solution of the mystery, and after trying several combinations of lenses, succeeded in making an instrument which magnified three times. It consisted merely of a leaden organ pipe, with a plano-convex glass at one end and a plano-concave at the other. This he carried to Venice, where it at once became an object of the intensest public curiosity. He presented it to the Senate, who thereupon confirmed him in his professorship for life, and raised his salary to one thousand florins."

After getting possession of the principles involved, he soon constructed a telescope which magnified eight times, and at length another which had the power of thirty. The wonders of the heavens now unfolded to him that which no man had ever seen before, and which filled

him with unspeakable delight. His earliest observations were upon the moon, whose inequalities of surface he was the first to trace. He saw myriads of stars in the milky way; counted forty in the Pleiades, and at length, on January 13, 1610, after six nights' observation, discovered the revolution of four satellites around the planet Jupiter.

He did not publish this intelligence until by repeated examination, up to March 22d, he had insured himself against the danger of mistake. The account of his discoveries he entitled "Sidereus Nuncius." The "Sidereal Messenger" was received by the astronomers of the old school with insults and incredulity. "Some exclaimed against the impiety of scooping out valleys in the fair face of the moon. Some attempted to explain away the satellites of Jupiter as mere appearances caused by reflected light. A professor in the University of Padua argued that as there were only seven metals, seven days in the week, and seven apertures in a man's head, so there could be but seven planets; and when forced to admit the visibility of the satellites through the telescope, he reasoned that, being invisible to the

naked eye, they were useless, and consequently did not exist." (*American Cyclopædia.*)

The discovery of the telescope led Galileo also to the invention of the compound microscope. He is also entitled to the discovery of using the pendulum for the measurement of time in the construction of the clock.

Galileo was the first to announce that Saturn was triple, an appearance which subsequently was shown to be caused by the planet's rings. He was also the first to notice that Venus exhibits phases like those of the moon, and to descry spots on the sun's disc. He was, at least, the first to note their peculiarities, and to infer from them the sun's rotation.

In 1611 Galileo removed to Rome and erected his telescope in a public garden. He was at first received with the highest honors, and became a member of the famous Lincei Academy. At this point Galileo had reached the zenith of his glory. The very prominent position now taken by the bold philosopher became the occasion for the beginning of the severe persecution which soon followed. The Copernican system, which he had taught in

public, afforded a good pretext for attacking him. The sun's revolution round the earth was thought to be a truth of Scripture. Certain Tuscan ecclesiastics began to preach against the wickedness of sending our world spinning through space, and a sarcastic Dominican hurled a sermon at Galileo from the text: "Ye men of Galilee, why stand ye gazing up into heaven?"

In 1613 Galileo addressed a letter to his pupil, Castelli, showing that the language of the Bible should be interpreted according to popular ideas, and that the Ptolemaic system is really as much at variance with it as the Copernican. This was followed by one to Christina, grand duchess dowager of Tuscany, reiterating his views and supporting them by quotations from the writings of the Fathers. A Dominican, Lorini, laid a copy of the Castelli letter before the Roman Inquisition, in February, 1615. But the Inquisitors refused to act in the matter, remarking that by confining himself to the system and its demonstration, and letting alone the Scriptures, Galileo would be secure from molestation. His enemies, however, continued their intrigues,

and about the end of 1615 he went to Rome, either to obtain a formal sanction of his opinions or in obedience to a summons. His case came again before the holy office. In February, 1616, he was charged with teaching that the sun is the center of the planetary system, and interpreting Scripture to suit his own theory.

The qualifiers of the Inquisition pronounced the obnoxious doctrines formally heretical, because expressly contrary to Holy Scriptures. Galileo's letters to Castelli and the grand duchess, Copernicus's work on the heavenly bodies, and Kepler's "Epitome of the Copernican Theory" were placed on the Index Expurgatorius, whence they were not removed until the time of Benedict XIV, and Galileo himself was forbidden ever again to teach the motion of the earth and the stability of the sun. Thenceforward he was not permitted to express himself, as though Copernicanism were, in the words of the Roman *curia*, "an actually grounded hypothesis." But he was permitted and encouraged to use the hypothesis most actively as his clew to fresh scientific results, and to treat with the most ample justice the

scientific arguments for and against. He was permitted to maintain that Copernicanism was scientifically likely, in the highest possible degree; but he was not at liberty to teach expressly that it had received absolute and irrefragable proof.

He had an audience with the pope, however, who assured him of his protection, and in 1617 he returned to Florence. Sickness prevented him from observing three comets which appeared in 1618, but he entered warmly into discussions about them, and is supposed to have had the chief share in a lecture delivered by his friend Guideci, and printed in 1619, in which they were held to be only meteors. This discourse was attacked by the Jesuit Grassi, under the pseudonym of Sotario Sarsis, and defended by Galileo in his "Assayer," one of the most beautifully written of his works.

On the accession of his friend, Cardinal Barberini, to the pontificate, under the title of Urban VIII, he went to Rome to offer his congratulations. Arriving in the Spring of 1624, he received during the two months that he remained every mark of esteem and liberal-

ity. The pope granted him a pension of one hundred crowns, and one of sixty crowns to his son. He now set about composing a work in which he might sum up all the arguments for and against his favorite theory. It was written in the form of dialogues, and accompanied by a preface, in which he protested, ironically, against the idea that the decision of the Inquisition in 1616 was rendered through ignorance or passion. He says that, on the contrary, its officers listened with attention to his statement of the scientific arguments on which his theory was based, and maintains that the grounds upon which this decision was justified were entirely religious.

The book was published at Florence in 1632, under the title of "Dialogue on the Two Principal Systems of the World, the Ptolemaic and Copernican." This being regarded as a violation of the injunction, Galileo was ordered to appear in person at Rome, where he arrived in February, 1633, and took up his quarters with the Tuscan embassador. His trial was short. The principal ground of complaint was the disobedience of the command of 1616, and the scientific reasons which Galileo again urged in

support of his theory were not appreciated any better than before, but were met with religious arguments. The sentence was solemnly pronounced June 22d. It set forth the offense of the accused in teaching a condemned proposition, violating his pledge, and obtaining a sanction for his book by improper means, declared him to be vehemently suspected of heresy, required him to abjure his errors, and all other heresies against the Catholic Church, prohibited his "Dialogue," and condemned him to be imprisoned at the Inquisition during pleasure, and to recite once a week, for three years, the seven penitential psalms. Galileo made his abjuration with all the formality which commonly attended such proceedings; clad in sackcloth and kneeling, he swore upon the Gospels never again to teach the earth's motion and the sun's stability; he declared his detestation of the proscribed opinion, and promised to perform the penance laid upon him. Then, rising from the ground, he is said to have exclaimed, in an undertone, "*It does move for all that.*" After four days' confinement under the holy office, Galileo returned to the Tuscan embassador's, but for the rest

of his life he was kept under surveillance. He passed some time in Siena, in the archbishop's palace, and in December he entered his own house at Arcetri, near Florence, where he remained until the close of his life.

In 1638 his book of "Dialogues on Locomotion," completed two years before, which he prized above all his other works, was printed at Amsterdam by Louis Elzevir. In 1636, also, he discovered the moon's diurnal libration. (*American Cyclopædia.*)

Galileo died January 8, 1642, aged seventy-eight years. He performed a most valuable and important service to the cause of true science under dangers, darkness, and difficulties that truly tried men's souls! When called before the Inquisition the second time, and required in solemn form to abjure and renounce the truth of his cherished doctrines, how much better would it have been for the glory of his name and memory and the cause of truth if, like Luther, under similar circumstances, before the Diet of Worms, he had said: "Let me be refuted and convinced by the testimony of the Scriptures or by the clearest argument; otherwise I *can not* and WILL NOT RECANT;

for it is neither safe nor expedient to act against conscience. Here I take my stand. I can not do otherwise, so help me God. Amen."

These words shed a radiance of glory over the name of Luther, as imperishable as the light of heaven. Galileo recanted on his knees, before God, that which his own convictions told him was true—a self-vindicated truth—and rising from his knees and in an "*under tone*," saying that "the world does move, after all," is but a poor apology for his cowardly recantation. But if we can not justify the act we must pardon the offense.

SIR ISAAC NEWTON is the next most distinguished author recognized as authority in the science of astronomy. He was born at Woolsthorpe, Lincolnshire, England, December 25, 1642, the same year that Galileo died. He is characterized more as a general philosopher than as an astronomer. The great essential facts in the Copernican system of astronomy had been discovered and adjusted in their proper order in the system before his day.

"He ranked low in his class in school for

some time, but being ill treated by the boy who stood next above him, he determined to defeat his opponent in class work, and applied himself with such resolution to his books that he at length stood at the head of the whole school."

He entered Trinity College, Cambridge, in 1661, where he graduated in due time. As a scientist he first gave attention to chemistry and the investigation of the laws and properties of light, with other departments of natural science. The only new feature that he sought to establish as a part of the system of astronomy was that of his theory of "*universal gravitation.*" The falling of the apple from the tree under which he seems to have been resting, deeply absorbed in thought, gave rise to the inquiry, Why does the apple fall? Beginning at this point, the subject seems to have expanded upon the field of vision until it became "*universal.*"

Astronomy, like every other science, embodies a number of well ascertained and demonstrated *facts* and *principles* of a kindred and harmonious character, wrought into a system, which, when brought into united action,

are expected to produce certain results. In Sir Isaac's case he had the single fact that the apple fell, for which he sought a cause. That cause was found to be gravitation, or the attraction of the earth upon the apple. All of this is true and well sustained by facts. It is a matter of fact that the earth possesses the power of attraction upon all ponderable substances falling within the range of its influence arising from this force. Under the influence of *terrestrial* gravitation every thing pertaining to the earth, including its atmosphere of ponderable matter, presses upon the center of the globe, where all its parts are equally balanced upon its own center. This is a necessary and wise provision in nature, and constitutes our earth as a complete and perfect whole.

But where does Sir Isaac find facts sufficiently clear and well defined to extend this gravitating power to the sun or other planets? Here facts are wanting, and where they cease to appear every wise and practical reasoner must pause before he proceeds to take another step in advance.

The *facts* in astronomy have been clearly ascertained and set forth by Copernicus, Kep-

ler, Galileo, Newton, the Herschels; and others of merit that might be named have each done valuable service in pointing out existing facts—the numbers of planets belonging to our solar system, their magnitudes and positions in the heavens; and some have discovered new ones and added to the system from time to time, and all these facts together form the system as a whole, about which there is no controversy or disagreement whatever—but universal gravitation is not a fact.

Beyond this it is equally known as an established fact that all the heavenly bodies are in motion, both upon their axes and in their orbits. The appointed times for the appearance and departure of each are also known as a matter of fact. Now, as no controversy can arise as to questions of fact, the common reader will inquire, Why should there be a disagreement in regard to the subject at all? This question is in point, and must be considered.

1. Behind these well defined facts certain questions will arise to the intelligent observer as to the dimensions of the sun and each of the planets, their relative distances from the sun and from each other, and the speed made

by each in its revolutions upon its axis and in its orbit, when eclipses will occur, and at what points on the earth's surface these will be visible or invisible. These questions belong to mathematical astronomy, and can only be understood and determined by those who are skilled in the theory and sciences of mathematics and astronomy in their proper relations to each other.

2. Another question demands an answer, What causes are in action to propel and keep in uniform motion all the heavenly bodies? On this question there is room for a difference of opinion, and to answer this question the electric theory is offered to the public.

It is chiefly on the question under consideration (the causes of the motions of the heavenly bodies) that Sir Isaac Newton offers his system of universal gravitation. It is not my purpose here fully to consider it; but so to state its doctrines and principles that in presenting the electric theory reference to his system may be better understood. The theory, in substance, is briefly as follows:

(1.) No cause is given for the diurnal or annual motion of the earth, except that given

it by the great Creator when he hurled it from his hand, whirling upon its axis and rolling in its orbit.

(2.) To preserve and perpetuate this motion through all time, Sir Isaac holds that all bodies thrown into motion must continue in that motion until something stops them; that beyond the atmosphere of the earth (which is a part of it) there is an open void, a *vacuum*, in which it meets with no resistance, and that, therefore, it must ever keep the same identical motion.

It is true that a body once thrown in motion will continue to move in the same direction until something stops it. But there are no *voids* or *vacuums* in nature; there are opposing influences that will stop its motion, and hence the position is not correct—not supported by facts. It is now well known that light, heat, and electricity pervade the whole universe, and that there are forces inherent in these agencies adequate to repel or augment the motion of all moving bodies.

(3.) Again, bodies thrown into motion continue to move in direct lines, unless drawn into a curved line by an adequate force. This

was known by the author of the universal gravitation doctrine, and hence he employs the universal gravitation of the sun for this purpose—the centripetal force—and this, he holds, is balanced by a centrifugal force—a disposition to move in a direct line—and by the action of the two the earth is kept in its orbit, which is known to be an elliptic one, all by the momentum given it when the morning stars first sung the anthem of creation millions of years ago, if we are to take geological dates for the event.

Now, let it be remembered that the gravitation doctrine endows the sun with the power of attraction only—one power—and it is confessed that if this centripetal force should overcome the centrifugal, then the earth would be drawn in upon the sun and be consumed; or if the centrifugal force should predominate, then the earth would run riot through space and be lost. In the electric theory it will be seen that no such contingency is possible, and that natural laws render both events impossible.

Let it be observed, further, that the theory of universal gravitation, as taught by Sir Isaac

Newton, does not account in any way for the polarity of the earth or the inclination of the poles, both of which must be regulated by the forces which control and regulate the motions of the earth, both of which are satisfactorily accounted for by the electric system in the following pages. No reflection upon Sir Isaac Newton or any other astronomer of former times is intended by these remarks, for, in their day, the universal prevalence and forces of electricity were wholly unknown to them, as will be shown.

Sir Isaac Newton died in 1727, when Dr. B. Franklin, the first great electric philosopher, was just twenty-one years of age.

## Chapter II.

*ELECTRICITY DEFINED—ITS EARLY DISCOVERY—ITS ACTION ON THE DIURNAL MOTION OF THE EARTH.*

ELECTRICITY is defined to be "The science which treats of the peculiar phenomena of attraction and repulsion exhibited when friction and other mechanical forces are applied to bodies, and of certain effects which accompany chemical decomposition or other change of physical state; or the phenomena that arise from the relation which bodies may bear to terrestrial and other magnetic lines, particularly when these are undergoing change in quality or direction. The general science includes statical and dynamical electricity, or electric force in a state of rest or motion. The former being usually developed by friction, at least for experimental purposes, is often called frictional electricity. The latter may be developed by chemical action, by heat, magnetism, and other forces; but in whatever way

produced, it is always in the form of currents, and exhibits a constant manifestation of power."

Though no one may be able clearly to define and point out the nature and essence of electricity, in itself considered, yet enough is known of the laws which govern its action and the results produced for all practical purposes.

The word electricity is derived from the Greek word for amber. Thales, of Miletus, 600 years B. C., finding that by rubbing a cake of amber with a piece of silk, sparks were emitted, came to the conclusion that the amber was a living body, and that when irritated by rubbing the soul came out in the form of fretful sparks.

Very little was known of the sources and nature of electricity until near the close of the sixteenth century, when Dr. Gilbert, of Colchester, England, made a series of experiments, on account of which he was called the founder of the science. No such title could be given to any man, at a time when only a few isolated facts were known. Robert Boyle, Otto Von Guericke, Sir Isaac Newton, Sir David Brew-

ster, Stephen Gray, and others, about the same time, each made many experiments, developing a few unimportant facts in regard to the science; but no man ever conceived the idea that electricity was an all-pervading element of power, filling the entire universe of space, until Dr. Benjamin Franklin, in 1752, made his experiments upon the clouds, and drew the lightnings of heaven harmless at his command. All other experimenters before him labored under the idea that electricity was some peculiar element in nature, only found in a few substances, and, as a matter of scientific curiosity, they labored to develop and analyze it. Thus, for more than two thousand years after its first discovery, with no material progress made, it remained for Dr. Franklin to reveal the fact that every generation of men, from Adam to the present time, had lived and breathed and had their perpetual being in an ocean of electricity as boundless as the universe! After the lightnings of the heavens were summoned by Franklin to bear testimony to the fact that they were identical with the electricity of the earth, then it was plain enough to be understood by all men.

The only practical result suggested by Franklin's discovery, for some years, was that lightning-rods placed upon our dwellings and public edifices would be a protection from danger. On this the world rested in content for eighty years or more, when Morse conceived the idea of utilizing the electro-magnetic current produced by chemical action as a means of transmitting intelligence over a line of soft iron wire, which is now regarded as one of the greatest wonders of the world.

Electric wonders stop not here. Some fifty years ago Judge Richardson, of Illinois, a plain but very thoughtful and philosophical man, conceived the idea that in this vast universe of ours, all filled with light, heat, and electricity, there must be a good reason in the mind of the all-wise Creator for thus flooding the universe with such a vast supply of these elements. Surely they have some greater offices to perform than that of merely giving light and animation to the animal and vegetable world. Under this train of reflection the question occurred to him, May not electricity have something to do with giving

motion to the earth and all the planetary worlds?

Being acquainted with the fact that there were both attractive and repelling forces in the sun, as the great central force of light, heat, and electricity, he soon perceived the fact that that part of the earth's surface which is turned away from the sun for twelve hours must pass from a positively electric condition to a negative state; and that as it is a law of electric action for positive electric bodies to attract negatives, therefore the sun must attract the rising side of the earth from six o'clock in the morning until twelve o'clock noon. But by this time the earth's surface immediately under the sun passes from the negative to the positive, and is therefore repelled, answering to the well-known law that all positive electric bodies repel all like bodies. Thus, by attracting one side and repelling the other, a rotary motion is given to the earth, by which we have day and night.

There are results growing out of this diurnal revolution that hold an inseparable connection with it, which were overlooked by Richardson, and have not been satisfactorily

accounted for by any other theory, modern or ancient, that has fallen under my notice. I allude to the magnetic character of the earth, its polarity, and the interchange of ocean currents between the poles.

The revolution of the earth upon its axis from west to east, passing its surface at the rate of one thousand miles an hour under the direct rays of the sun, has the effect (conjointly with its native magnetism) to convert the whole earth into a magnet. As a proof that it is so magnetized it takes to itself a polarity, under the law that all magnetized bodies are polarized. This polarity of necessity is at right angles with the current of electricity which passes around the earth.

This important feature of the magnetic character of the earth, with its polarity, has never been noticed by the advocates of the Newtonian theory, for the reason they had no knowledge of the all-pervading presence and power of electricity. This defect in their system is fatal to a correct exposition of the laws which control planetary bodies.

It is not to be understood that the earth receives all the magnetism it possesses from

the sun, for it is endowed with a magnetism peculiar to itself, and of an opposite character to that of the sun, called negative electricity, which permeates the whole body and gives it polarity. The electricity derived from the sun, which is positive, never enters solid bodies, but rests upon their surface only. Therefore the positive current from the sun, strongly attracted by the negative of the earth, rests upon the surface only. Here it controls its motion upon its axis and holds its polarity at right angles with its current, and otherwise its opposite character keeps it continually under the government of the sun.

Thus, according to known laws of electric action, we account for the revolution of the earth upon its axis, its magnetism, and its polarity, by *self-adjusting* forces which secure a uniform and unwavering course of action through all time. We repudiate the idea that the space beyond the atmosphere of the earth is a vacuum, and that a celestial body simply by the *momentum* given at its creation continues to move because there is nothing to interrupt or impede its progress. The facts are, there are no vacuums in nature, but universal

space is occupied by light, heat, and electricity, which are the real elements of force, and controlling power of all motion. Hence, without the action here contended for, the earth would cease to roll, and the great wheels of nature would stand still until a force more potent than "*momentum*" came to the rescue.

## Chapter III.

*RESULTS OF THE POLARITY OF THE EARTH.*

THERE are several legitimate results growing out of the magnetic and polar constitution of the earth, not recognized as such by the Newtonian theory, and not sufficiently elaborated in my former chapter, to which I now proceed to call attention.

1. The interchange of the ocean currents between the poles is one of these results. It is known that not only the boreal and austral poles, but nearly three-fourths of the earth's surface, are covered with water, and hence there is an excellent medium for magnetic connection between them. It must be borne in mind that as the whole earth is strongly magnetized, and the force of this magnetism centers in the poles, the magnetic power concentrated at each is very great, as is shown by the effects produced.

The waters covering the boreal pole over a very large surface are thrown into a strongly

positive magnetic condition, and as positive repels positive, they are sent off with great force, sweeping around the globe; bearing towards the equator, and passing it, they make their way to the austral pole under the double influence of repulsion from the north and the strong attraction of the negative austral pole. As this current sweeps near to and passes over the negative or south pole, it changes from the positive to the negative condition, and is again repelled in an opposite direction around the globe, controlled by the channels of the ocean, back to the north pole, now attracted by its positive force. Thus a ceaseless circulation of the waters of the deep is produced, carrying beneficial and healthful results to all parts of the earth, and aiding in the equalization of the temperature of the ocean, as in passing from either pole to the other the waters are subjected to tropical heat, which they modify.

The icebergs formed in the polar regions are by these forces carried towards the tropical seas, whence, by a natural process, they are dissolved and their magnetic condition subsequently changed by the opposite polarity. The

narrow limits of my space will not permit me to go into details here.

2. The atmosphere of the earth with all the meteorological phenomena connected with it, is controlled by the combined electric agencies of the magnetism of the earth and the electricity from the sun, producing a system of permanent, periodic, and temporary, high and low barometers, which regulate and control atmospheric action.

There is a central permanent low barometer lying along the equatorial line over the ocean, and two permanent high barometers, one on each side and parallel with the great central low barometer, 23½ degrees distant, forming the outer boundaries of the torrid zone. Through these two high barometers there is a descending current of air, cool and pure, which divides, sending off on the equatorial side a current which flows to the central low barometer, through which it rises to the upper surface of the aerial ocean. These currents, called the trade winds, greatly reduce the temperature of the torrid zone. The other half of each current flows outward to the polar regions, unless interrupted by a periodic or temporary low barometer.

There are two great permanent low barometers, one covering each pole, which form an open vortex through the atmospheric regions, by which the winds and the accumulated excess of electricity find exit, the latter in our hemisphere giving us the aurora borealis. When the sun is on the opposite side of the earth, the excessive current of electricity accumulated during the day, under a favorable state of the atmosphere, is seen at midnight repelled upward, forming the grand display of the "northern lights."

Thus the polarity of the meteorological system relieves the earth of any excess of the forces essential to its own action. This reference to meteorological phenomena does not properly belong to the astronomic doctrines for which I contend, except so far as to account for the aurora borealis, and incidentally to show that electricity is the prime agent by which all natural phenomena are produced.

For a perfect knowledge of this system the reader is referred to Prof. Tice's able work on meteorology, based on the electric theory, published at St. Louis.

3. The polarity of the earth has much to

do with giving to this planet its fixed position and relations to the sun—the inclination of the poles always bearing the same position in all parts of its orbit in its revolution around the sun. The plane of the orbit is so arranged that at the vernal equinox the sun's rays fall equally upon the earth from pole to pole, but as it proceeds from March 21st to the Summer solstice, June 22d, the north pole is brought gradually under the light of the sun until it shines 23½ degrees beyond it. Though there is a vast difference in the electric condition of this pole when fully charged with electricity from the sun, and when just emerging from the shades of polar night, yet, it being the center of positive magnetic polarity, when it is presented to the sun's rays the general attraction between the sun and the earth is much less than when the magnetically negative south pole is presented. As the north pole is positively magnetic and the solar rays positively electric, there is a comparative repulsion between these two positive points, and hence the earth is now repelled by the sun to the most distant or aphelion part of its orbit. As it progresses to a higher point and this pole

gradually recedes, the repulsion ceases; it is again attracted so that at the Autumnal equinox, September 22d, it has recovered the distance lost in its outward movement and is as near the sun again as on March 21st. From the 22d September, in its course to the Winter solstice, it continues to rise so that the austral pole in a magnetically negative state is brought into light, and the earth is, therefore, now attracted till on the 22d of December it reaches its nearest or perihelion point of its orbit; when fully charged, it is again repelled.

Thus it is clearly evident that the polarity of the earth necessitates the elliptic form of its orbit as well as the inclination of its plane, otherwise the laws of electric action would be violated.

From the foregoing, every part of which is sustained by well established facts, it will be seen that the diurnal and annual motions of the earth are rationally and sufficiently accounted for without the agency of gravitation in any of the motions involved.

## Chapter IV.

*THE ANNUAL REVOLUTION OF THE EARTH THE RESULT OF ELECTRIC ACTION.*

WE have shown in a preceding chapter that the elliptic form of the earth's orbit and the inclination of its plane are constructed in strict conformity to electric laws.

It remains now to be shown that the earth is propelled and carried forward in the pathway of its orbit by the attractive and repulsive action of electric currents.

Before proceeding to show by what process this result is produced, a few general remarks will be necessary to bring the subject properly before the reader. We lay it down as an axiom in the laws of Nature that whatever God creates he governs; and the elements or principles by which his government is secured are incorporated in the organism, constitution, and structure of the thing created. This rule will apply alike to animate and inanimate forms of existence.

In the structure of the earth, therefore, the Great Architect of the universe must have foreseen the necessity of incorporating in its organism the elements of power essential to control its action, whatever that action might be. If the object of its creation was to take its position as a planet forming a part of the solar system, and to be placed under the control of the great central orb, the sun, then the elements of power implanted in it must correspond to, and be the counterpart of, the governing element of that central orb. When we thus analyze the Divine plans, we enter into God's great thoughts.

In a future chapter, when we come to consider the structure and functions of the sun, we shall show that it is the great central source of light, heat, and electricity, and it is by the active energies of these vital agents that all its planetary worlds are governed. The earth, then, must be endowed with elements of power corresponding in their nature to the demands of the sun upon it, which demands seem to have been fully met by constituting it a great polarized magnet of an opposite character to the electricity of the sun.

Now, let us suppose, for argument's sake, that the earth was endowed with the power or force of *gravitation* only, the question arises as to whether this gravitation is capable of performing the various offices we find necessary to establish a polarity in the earth, the interchange of ocean currents, the rotation of the earth upon its axis, the elliptic form of its orbit, and the driving force with which it is propelled forward in its orbit; and if incapable of producing any of these necessary results, and it corresponds to no quality whatever of the sun, then we may ask what office it does perform, and what the limit of its action.

We answer that the earth does possess a force which we call gravitation, whose office it is to hold the earth with its mass in a solid body, balancing upon its own center, and holding all the elementary constituents of its existence a unit, and to give stability and firmness to all the tenements and superstructures occupying a place upon its surface. It has a controlling influence over the atmosphere, and may extend its dominion to its own satellite, which is doubtful, and here its powers cease.

The idea that the sun is a solid body, and

that it exerts a gravitating force proportionate to its quantity of matter over the earth and all the other planets, is an assumption wholly unsustained in the light of true astronomic science, by any known facts, as will be seen when we come to treat of the sun.

By repudiating the doctrine of UNIVERSAL GRAVITATION we are relieved from darkness and difficulty on many subjects that have their origin in this fallacious theory.

1. It is contended that our earth and all other planets are endangered in a liability to fly from their assigned orbits, and to come in collision one with another, producing "a wreck of matter and a crash of worlds;" whereas, by our theory, all the planets in the system being heavily charged with negative electricity, repel each other, making such a collision a natural and scientific impossibility.

The repelling force existing in each planet against all others is demonstrated by the experiment of the pithballs upon an electric machine. If we attach a dozen pithballs to the conductor by light threads six inches long, and throw a current of electricity on them, they all rise and stand apart, each repelling

the other at equal distance in all directions. The same law acts upon the planets in like manner.

2. The gravitation doctrine holds that the earth, in revolving in its orbit, is kept upon a balance between the centripetal and centrifugal forces, which are said to control it in its action, and should the centripetal bring the earth too near the sun, it would immediately plunge into the bosom of that luminary and be consumed; and should it depart too far, the centrifugal force would gain the mastery and carry it riotously into the outer regions of space, where it would be lost.

Both of these suppositions are as false as the premises on which they are based. To demonstrate this we have only to allude to the eccentric course of the comet, which, moving in a very elongated ellipse, comes dashing in from the remotest regions of space, and directs its course so near the sun that it passes between it and the nearest planet, almost touching the corona of the sun, and yet it does not fall into it. On the contrary, being a nebulous and not a solid body, it becomes charged with positive electricity from center to cir-

cumference, and is therefrom repelled and driven again to its distant aphelion, where, losing its positive character and becoming negative, it is recalled to the sun for a fresh supply. In this action of the comet it certainly crossed both danger-points, and was neither consumed on the one hand, nor lost in distant space on the other. From the foregoing and other considerations, we do at once and forever exclude the doctrine of universal gravitation from any agency whatever in connection with the solar system.

The question now recurs: By what force is the earth carried forward in its orbital journey around the sun? After much serious and patient consideration, we are driven to the conclusion that the same forces which cause its diurnal motion are employed in giving it its annual motion also.

In one thing we agree with the great Christian philosopher, Sir Isaac Newton, that is, that the All-wise Creator, after the earth was complete and perfect in all its parts, launched it forth whirling upon its axis, and moving forward in its orbit by a momentum given it at the beginning; but we do not think with

him that this momentum would maintain it in unabated motion forever. All that was necessary to perpetuate its revolutions was added by placing it under the control of the electric currents of attraction and repulsion emanating from the sun. This being done, his work was complete, and God rested from his labors.

We have shown in our second chapter that by attracting that side of the earth which had passed through the shades of night and thereby become negatively electric, it was drawn towards the sun from west to east, so that so much of the surface as reached the meridian became charged with positive electricity, and the receding side was repelled, giving to the earth its diurnal motion.

I now take the position that the receding side of the earth, being heavily charged with electricity, is not only driven with a sufficient force from the sun to cause its rotation on its axis, but there is a great excess of force repelling it forward in its orbit. I adopt this idea for the reason that on the negative or rising side of the earth there is no resisting force, but a strong attraction drawing it in the same direction.

This position gains strength from the consideration of the fact that light, heat, and electricity are imponderable, and therefore incapable of momentum. That when the rays of the sun, combining all these elements, strike the earth, not centrally, but on its eastern border, the light is converted into heat, and ultimately into electricity proper, which expends its force in all directions; hence a lateral force is as natural to it as a perpendicular. In a circular area of 8,000 miles in diameter, covering the eastern side of the earth, beginning at midday, and exhausting itself at midnight, a vast body of positive electricity is accumulated and must strike the earth—the only opposing surface near it—with immense force, driving it in the direction of its course on its orbit; while on the other side there is a comparative electric vacuum into which it is continually plunging, and is driven on its orbital path, as is commonly estimated, at the rate of 68,000 miles an hour.

In the further consideration of this subject it must be borne in mind that the earth is confined in its distance and relations to the sun by a strong attractive force on but *one* side,

and hence the only direction that it can find retreat from the immense force pressing upon it is in the direction of the line of its orbit, which sends the earth around the sun, as seen from a northern standpoint, in the opposite direction to the hands of a clock, but as seen from a standpoint south of the equator, its motions are in accordance with those of the hands of a clock.

These are legitimate results, growing out of the application of the forces as they are known to act in producing the annual motion of the earth in its orbit.

## Chapter V.

*OFFICE AND INFLUENCE OF THE MOON.*

THE average distance of the moon from the earth is 238,818 miles. Its diameter is 2,159 miles, and it makes a revolution around the earth in a fraction less than twenty-eight days. This is called her mean sidereal revolution. To this motion are due her monthly phases. The course of these phases, however, is only completed in a lunar month, or synodical revolution, the mean length of which amounts to twenty-nine days and a fraction. The phases depend upon the moon's position with regard to the sun, which is constantly advancing in the direction of her motion; so that, after completing 360° of her orbit, she has the whole amount of the sun's progress, which is an arc of about 29° to pass over before she can complete her course of phases. The former period is called the sidereal month; the latter the synodic month.

The hemisphere of the moon presented to

the sun is always illuminated, except when eclipsed. The illuminated side becomes more and more visible to the earth as the moon recedes from the sun eastward, until it reaches the full, when the earth is in a position between the sun and moon and the full illuminated side is seen.

From the constancy of the physical features of the moon's disk, it is evident that she always presents to us the same hemisphere. To do this, she must turn upon her axis precisely once while making her revolution in her orbit.

The body of the lunar orb is a solid opaque substance, only capable of receiving and reflecting light from the sun.

It is not to be supposed that the moon was created as a habitation for men or animals, and therefore it possesses no capacity to produce plants. If this is true, then there is no necessity for an atmosphere, clouds, or rain, and we conclude that it is possessed of neither.

If we can correctly determine the design of the Creator in attaching a satellite to our earth, it will materially aid us in arriving at a just interpretation of its true character and office.

It will not do to say that it was only created to give light by night; for in that case it would always act as at full moon; that is rise at sunset and set at sunrise. There are manifestly more numerous and more important services to be performed by the moon than is generally supposed. After many years of reflection on the subject, we have arrived at the conclusion that the agency and office of the moon is to give diversity of currents and force to the elements employed by nature to keep up a healthy and vigorous action over all parts of the earth's surface, in connection with the same, and acting the part of a local regulator of atmospheric currents and conditions, and thus perform the part of a sub-agent, under the sun, in giving perfection to the wise and generous provisions of nature in carrying out her beneficent designs towards the earth and her numerous offspring.

To fulfill and accomplish this design, the moon must be endowed with more power than that of merely reflecting light and influencing the earth by *gravitation.* It receives from the sun a heavy charge of electricity, by which it is armed with the power of attraction and re-

pulsion equal to the functions required of it in the economy of the general laws of the electric system by which every thing in the solar system is governed.

When it is remembered that the moon only revolves on its axis once in a lunar month, the illuminated side continues to receive a full discharge of positive electricity from the sun for one-half of twenty-nine days, and thereby must necessarily become intensely positive on that side, this necessarily induces the same intensity on the negative or dark side, so that, indeed, its electric tension must be vastly greater than an equal amount of surface on the earth where any given portion only remains illuminated twelve hours before a change takes place. With these facts in view, it is not strange that the electric attraction and repulsion of the moon on the earth is so very great, as seen in the production of the tides.

It is universally admitted that the ebbs and flows of the tides are the result of the action of the moon upon the waters of the ocean. The only question in controversy in regard to the tides is this: Are they produced alone by the supposed law of universal gravitation, as taught

by old school books, or by the mutual electric attraction and repulsion between the earth and the moon?

If we can fully account for the ebbs and flows of the tides upon the electric theory, we shall not consider it necessary to argue the insufficiency of the gravitation doctrine. When the negative, or dark side, of the moon is presented to the illuminated side of the earth, as at the change of the moon, by mutual attraction, we have high or spring tide—this is a well-known fact. Another fact, equally well established, is that when we have spring tide on one side of the earth, there is on the opposite side also another spring or high tide, where there is neither sun nor moon to attract the waters. What has gravitation to do with this antipodal tide? If no satisfactory answer can be given on the gravitation side of the question, then we offer the following on the electrical side:

It is well known that the ocean is strongly charged on its surface and for several feet below with positive and negative electricity, which are in a neutral state.

When the dark or negative side of the

moon is presented to the positive side of the earth, there is a strong mutual attraction between them, and the moon being negative at this time it only attracts the positive electricity found in the water, and repels the negative in an opposite direction.

The waters thereby become polarized, with the positive pole under the moon, which necessitates the formation of the negative pole on the opposite side of the earth.

The earth, being in a magnetic state, forms a connection between the poles, and hence the antipodal tides are produced.

When the moon is at its full it is at the opposite side of the earth from the sun, and presents its positive side to the negative side of the earth, when the same result is produced, with the exception that the negative end of the pole is then toward the moon.

These antipodal polarities revolve around the earth, always presenting one of the poles at a point of about forty minutes in the rear of the moon's position.

At the first and third quarter of the moon, and all other times, the tides, in fullness, will correspond to the amount of opposite electric

surfaces presented by the earth and moon to each other. But gravitation acts at all times alike, according to the quantum of matter in each body, and can not vary its force.

Here, then, we have demonstrated the fact that the moon exerts a very powerful influence over the waters of the ocean, heaping up its waters on both sides at the same time, and that the force by which it is done is purely electrical. Now the question arises, does it exert a like influence on fluids outside of the ocean?

I here state a fact with which we have been acquainted for more than fifty years. It is this: In all the Western States, in old time, the tanners, who use a large quantity of oak bark for tanning leather, procure their stock of bark in the Spring when the sap is rising in the trees. In some places they begin in the *light of the moon*, in April. They find that the sap, which runs freely in the light of the moon, ceases after the full of the moon, and they have to suspend work until the light of the moon in May, when it again runs freely. The same thing occurs after the full moon in May; and again in June; in northern latitudes, it runs

well in the *light of the moon.* All observing country people are fully aware of these facts, also, that foliage and flowers of early Spring develop much more rapidly in the light of the moon than in the dark.

Now, if the moon holds this controlling influence over the circulation of the sap in trees, all trees, why may it not equally influence the circulation of the blood in animals and men?

Some physiologists contend that in the months of May, June, and July, during the *light of the moon,* the sexual propensities of all animals are greatly more excited than at other times. This will be generally recognized as a fact.

How shall we account for all these differences? Certainly not on the principles of gravitation; but by the fact that the moon, when near its full, sheds forth a large amount of electricity—the all-inspiring agent at night—at a time when negative electricity generally prevails, which, added to the ordinary amount furnished by the sun, tends to animate the life current to excessive action.

In the light of all these facts, we ask the visionary captious objectors whether those old

sayings, so universally used by old farmers, that there is a right and wrong time of the moon for planting certain kinds of seed, are to be denounced as "superstitious?" These questions are only to be correctly decided by a long course of careful experiments.

The moon certainly has a great agency in disturbing and controlling the electric condition of the atmosphere, which often superinduces rain. It crosses the earth's equator, back and forth, about twenty-six times in the year; it ranges over a wide space in its inclinations to the North and South, and as it is ever imparting electrical currents where it is present, it can not fail to affect the electrical conditions of the atmosphere, and, as a consequence, contributes that condition most favorable to rain.

There is a tendency in all natural moving things—as water, air, and floating bodies—to find a state of rest—an equilibrium—while the law of life in this universe is the law of action. The electric machinery—the sun, moon, and earth—labor to keep up the vital current of healthy action. If, in the combined action of these powerful and active forces, storms—

thunder and lightning—should occur, it is all the better for a pure and healthy condition of the living and breathing creatures that depend upon Mother Nature for her bounties and benefits.

The moon has an important part to play in keeping up the activities about us in nature that no stagnant pools of disease or pestilence shall befall us.

The polarity of the moon is an unsettled question. The polarity of the earth, created by a current or belt of electricity passing around it, is wholly confined to the earth. The moon is outside of the current and does not participate in it. Its revolution upon its axis, once in a revolution in its orbit, is too slow to produce a polarity of any great force; yet a polarity is necessary to hold it in its proper position to the sun and earth. This it doubtless has, as there is such a heavy charge of electricity constantly upon its surface.

The moon presents a mild and agreeable object in the heavens for contemplation—one that inspires the poetic muse. Addison says of it as follows:

> Soon as the evening shades prevail
> The moon takes up the wondrous tale,

And nightly to the listening earth
Repeats the story of its birth;
While all the stars that round her burn,
And all the planets in their turn,
Confirm the tidings as they roll,
And spread the truth from pole to pole.

What though in solemn silence all
Move round this dark terrestrial ball;
What though no real voice or sound
Amid the radiant orbs be found;
In reason's ear they all rejoice,
And utter forth a glorious voice,
Forever singing as they shine:
"The hand that formed us is divine."

The moon revolves around the earth in its assigned orbit from west to east, though its apparent motion is from east to west, occasioned by observations made from the revolving earth.

I have not attempted, as in the motion of the primary planets, to set forth in detail the mode of action of electric laws in propelling the moon forward in its orbit around the earth, as this subject differs widely from that of the revolution of the primary planets around the sun, and therefore investigation has been very limited in this direction.

The theory presented by gravitationists is

that the moon, thrown into action like a cannon ball on a straight line parallel to the earth's surface, is drawn into a curve by the attraction of the earth, and that the curvature of its fall forms the line of its orbit encircling the earth, and that its momentum alone is the force by which it is kept in perpetual motion. This theory must be rejected, as it has been found that the laws of electric attraction and repulsion are alone employed in the motions of all the heavenly bodies, as seen elsewhere.

It is difficult to define the *modus operandi* by which the laws of electric action are made to sustain the moon in accomplishing its revolutions. Professors Henry and Tice agree in stating that all magnets of great magnitude are surrounded by circling currents of electricity.

Under the light of investigations made by Faraday, the great English chemist, a pupil of Sir Humphrey Davy, and of Ampere, the French philosopher, it was found that heavy currents of electricity were produced in and around each primary planet, apparently to subserve the local demands of the planets themselves. The theory in full, then, is this:

Currents of electricity, originating in the action of the sun upon the earth, superinduce strong electric currents through the body of the earth, passing from east to west. These subterraneous conduction currents of negative electricity give rise, on the principle of induction, to convective currents of positive electricity in the atmosphere moving from west to east, according to the law of Ampere, that parallel currents of electricity, passing in opposite directions, repel each other.

It may be that in one of this concentric series of currents around the earth the moon's pathway lies, and it may be carried forward by its agency.

This idea is both suggested and sustained by the disposition and regulation of the satellites belonging to the planet Saturn, around which the concentric rings are made visible by luminous gases or substances suspended in them. So also in the case of the planet Jupiter, where there are fewer bands and a less number of satellites. I think we may rationally conclude by analogy that every planet attended by a satellite possesses like electric bands, belts, or currents, and hence the earth

has such, though they may not be visible to an observer on its own surface.

The science of electric astronomy is yet in its infancy, and there are doubtless many important facts and cardinal portions of the system to be developed by future investigation; and hence, in regard to the electric forces which propel the moon in its orbit, I take no definite position for the present, except that it must be by electric agency, but reserve the mode of its action to future developments.

The facts upon which I rely are (1) that the primary and secondary planets are all negatively electric and therefore repel each other, (2) that electric currents are known to move in circles, positive superinducing the current of the negative moving in opposite directions. Hence, when we arrive at a better understanding of the complex methods by which these currents are originated and controlled, we shall be led to the correct conclusion in regard to the process by which the moon is carried forward in its orbit. Until then it is certain we shall lose nothing in rejecting the absurd explanations given of this subject by gravitationists.

## Chapter VI.

*THE SUN THE SOURCE OF POSITIVE ELECTRICITY. — ITS EXPENDITURES AND RESOURCES.*

I HAVE attempted to set forth by a plain and natural method: 1, that the earth is polarized; 2, that the whole earth is consequently magnetized, and that this magnetism is peculiar to its own constitution; 3, that its revolution on its axis is produced and maintained by the attractive and repulsive force of the electric current proceeding from the sun and passing around it; 4, that this electric current holds the poles of the earth at right angles with itself; 5, that the polarity of the earth causes the interchange of ocean currents, and necessitates the elliptic form of the earth's orbit, and the inclination of its plane; 6, and that by electric forces the earth is propelled forward in its orbit.

In the last chapter I accounted for the ebbs and flows of the tides by the attraction and

repulsion produced by the electric action of the moon upon the waters of the earth.

I have adopted this order in developing my theory, as it sets forth the progressive steps made in the investigation of the subject for a half century, and hence it is the most familiar and natural mode that I could adopt.

It would have been more systematic to have begun with the sun, and to have followed the operation of causes to their legitimate result; but, for the reasons stated, I have begun with the facts and forces discovered in nature, and the reasoning has been to find an adequate cause for their existence and the chain of consequences running through the whole system has led me to the consideration of the SUN as the center and source of the great motor power which exerts a controlling influence over the revolutions and motions of all the planetary bodies.

For the data relied upon in the following, I am largely indebted to Appleton's *American Cyclopædia.*

### FIRST.—THE MAGNITUDE OF THE SUN.

The authorities pretty generally agree that the sun's diameter is 853,000 miles, while that

of the earth is but a little less than 8,000. The sun is, therefore, 1,253,000 times larger than the earth. Again, if all the planets of our solar system were consolidated into one body, still the sun would be 750 times larger than the whole. The magnitude of the sun is, therefore, ample for the offices assigned it, provided that it is otherwise properly endowed.

### SECOND.—THE COMPOSITION OR STRUCTURE OF THE SUN.

What is its structure? Is it a solid body like the earth? By no means; for if this were its character, it could only reflect and not emit light; and, as it has no near neighbors from whom to borrow it, we should, upon this supposition, be in worse than total darkness.

Not to stop here to consider the many false theories that have been presented to the world on this subject, many of which are simply ridiculous, we proceed to show what the sun must be, if, by its great Creator, its office is to be the receiver and dispenser of light, heat, and electricity; and if we then show that this is its office, our position will be sustained.

The sun alone is the source of *positive* electricity—negative electricity resides with earth and other planets. Positive electricity does not penetrate solid bodies, but rests alone upon the surface of such; but positive electricity does enter into the body of the sun, as we shall presently see, and, therefore, the sun can not be a solid body.

Recent writers have shown that while the volume of the sun is 1,253,000 times greater than the earth, yet in material substance it is only 316,000 times greater; and, therefore, it must consist of a light structure, very porous and vascular, admitting of a free circulation of the elements necessary to the outflowing and emission of the fluids which are thrown off from its surface.

This view of the subject is greatly strengthened by the fact that recent observations disclose that "the spots on the sun" are extensive caverns, or wide, deep apertures, reaching far down into the central regions of the solar body. As long ago as the days of Sir William Herschel he found one of these "spots" to be a vast vortex, measuring 50,000 miles across the mouth. More recent observations, both in

Europe and in America, fully confirm those of Sir William Herschel.

From the days of Galileo to the present time these spots have been observed, and no one seems to have undertaken to give a reason why they were so arranged, or for what purpose they were created.

THIRD.—THE SUN'S RESOURCES AND EXPENDITURES.

That the sun is issuing from its treasury, daily and hourly, vast floods of light, heat, and electricity is known to all men; but as to what the resources of the sun may be in keeping up this expenditure is not so well known.

A distressed astronomer of the old school recently promulgated the idea that the sun was fast consuming itself, as it had lost one-third of its former size, and it was now so scarce of material to keep up its flame it was gathering up the fragments of scattered meteoric stones and metals for the manufacture of light and heat for the universe! Are such fears to be indulged, or such philosophy to be tolerated? What are the facts? From what source does the sun receive its stores to compensate it for the very liberal supplies of light, heat, and

electricity lavished upon its family of planets? To these questions the electric theory returns the only satisfactory and rational answer. It is this: The sun originates nothing; it creates nothing; it consumes nothing; it is placed in the heavens as a great factor to receive and dispense the boundless floods of electricity with which God has filled universal space. Electricity exists in two states or forms—the static or quiescent inactive condition, and in the dynamic or active form or condition. That which has entered the sun's bosom in the static condition is quickened into the dynamic form and sent off by repulsion to perform its office on the distant planets; but the static supply surrounds the sun in infinite quantities, ever ready to obey the demands of the great central orb.

But the question may be asked, How can the outside supply enter the body of the sun, which is constantly sending off in great force, from all parts of its surface, a flood of flowing light and heat? It could not enter at all if all parts of the sun's surface emitted such flame; but this is not the case.

We have just seen above that the sun is

provided with a vast number of open mouths or deep caverns, some of which measure thousands of miles in diameter, from which nothing is emitted. These caverns are doubtless possessed of a great attractive force for static electricity, which is drawn in to any necessary extent to keep up a supply equal to the expenditures or emission proceeding from the flaming surface. Thus we find the physical structure of the sun precisely adapted to the office it was designed to perform; namely, to receive and dispense light, heat, and electricity throughout the solar system.

It would doubtless appear to many a work of supererogation to undertake to prove that the sun is the source of positive electricity. It is nevertheless true that there are some learned professors, gravitationists, holding high positions in the scholastic world, who have undertaken to show that the electricity for which we here contend is generated in the atmosphere by some undefined process of friction. Others, as Professor Ellis, of Philadelphia, would have us believe it is produced by the evaporation of the waters of the ocean. These and many other speculative philosophers

create the necessity of giving to the subject a more critical examination than heretofore.

That the sun is the source of positive electricity is susceptible of demonstration from many considerations, from which I select a few:

1. The facts and positions set forth in preceding chapters are based upon the attracting and repelling forces of electricity derived from the sun. If my doctrines and deductions as found in these are correct, and the sun does perform the offices therein ascribed to it, then the conclusion is inevitable that the source of power is derived from the sun. To which I add the following:

2. In regard to the rays of the sun, it must be remembered that all true electricians hold that in every solar ray there is a combination of light, heat, and electricity—three distinct elements; that these elements or properties are resolvable, one into the other, and that they act conjointly or separately as conditions may demand or circumstances require. In proof of this, try the following simple experiment: Take a sun-glass—a double convex lens of three-inch diameter—and so hold it as to pass

the rays of the sun through it and converge them into a focal point, and place a piece of charcoal in the focus, when it will be ignited at once. If you then take a small silver wire, whether five or five hundred feet long it matters not, so both extremities are before you, with a ball on the near or handle end and the other end pointed; then lay the wire near the ball in the burning focus, and sparks of electricity will pass off from the pointed end. Here, then, you have light, heat, and electricity all under the eye at the same time; one converted into the other, and all proceeding from the sun. If you doubt this, place your eye in the focal point and look through the lens at the sun, and doubt will be at an end.

We here ask special attention to three facts: 1, that the rays were manifested as light only before they reached the lens and after passing through it until they reach the focal point; where, 2, all the light is converted into heat, and here you have heat only so far as external appearances are manifest; but again, 3, this heat passes off into electricity proper, as is evident from its action through the wire, and here again we have light in the emitted sparks.

These facts are to be remembered when we speak of the action of electricity.

If the few solar rays that find a passage through a lens of three inches in diameter are found to produce such magic results, what may we not expect from the floods of light in which whole hemispheres are bathed? They certainly guarantee enough substantial force to arm the monarch of the solar system with sufficient power to control the action of every planet in his realm, and to stimulate and perpetuate the current of life in the vegetable and animal kingdoms.

3. The same facts are sustained by the following process in nature: The rays of light emanating from the sun, on their passage to the earth, are often intercepted by two or more strata of clouds, one above another. If the upper cloud wholly overshadows the underlying one it receives all the rays of the sun, in which case the light is converted into heat and electricity until it becomes so heavily charged that it seeks a communication with the cloud below, which, being negative as compared with the upper, has a strong affinity for and is drawn towards it. If the two do not approach

sufficiently near to produce a direct discharge they often, by the mutual action of the positive cloud above and the negative below, form connection by establishing a magnetic line of oxygen or hydrogen gas, around which, in a spiral form, the upper cloud discharges so much of its electricity as to establish an electric equilibrium between them. The spiral line, seen at a distance, presents the appearance of a zigzag current. If the upper cloud still accumulates a heavier charge from the sun, it may repeat its discharge many times to the cloud below. When the underlying cloud is heavily charged from its neighbor above, it seeks a communication with the earth by which to discharge itself.

It is an invariable law that, when clouds become heavily charged with positive electricity from the sun, they superinduce a great concentration of negative electricity on that part of the earth nearest the cloud. In some instances, according to the observations of Professor Tice, in damp, warm weather, the negative electricity may be seen at night dancing and glimmering with a bluish white light upon high points in the direction of the heav-

ily charged cloud above. In some instances the cloud may pass low enough to discharge itself upon mountain-tops, or by striking the tops of tall trees or other objects, which the fluid follows as a conductor to a point near the ground, where it comes in contact with the negative electricity of the earth and is neutralized by it. Positive electricity never enters the earth. Where two or more clouds near the same plane of elevation are well and equally charged with positive electricity they mutually repel each other, and are thereby distributed over a larger area of country. The economy of the equitable distribution of rain-clouds is subject to electric agency. Over this matter gravitation has no influence whatever. In the absence of this distributive force water-spouts would be of constant occurrence.

It is sometimes the case that the accumulated negative electricity on the earth becomes more dynamic, or active, than the positive in the cloud with which it seeks connection. In this case a magnetic line of gas is formed between the earth and the cloud, and there is a discharge of the negative electricity upward, in which case the positive electricity of the cloud

is neutralized and thereby robbed of its energy. Where the negative is the dynamic or active force, it bears the appearance of a bluish-white light; whereas the positive, descending to lower clouds or to the earth, presents the appearance of a reddish-white light. It is presumed from the above considerations that no reflecting mind should hesitate to believe that the sun is the source of positive electricity. That there are two kinds of electricity, as heretofore stated, one, native to the earth—the negative; and the other—the positive—derived from the sun, is evident both from the colors they present and the direction of their action.

## Chapter VII.

### *THE SUN THE CENTRAL SOURCE OF MOTION AND VITALITY.*

THE sun, when personified, is invariably spoken of in the masculine gender, while the earth and its satellite are invariably spoken of in the feminine. This nomenclature is suggestive of the office borne by the sun as the great central source of power, and his peculiar influence over the planets and other bodies of the solar system, as they possess affinities and properties which form the counterpart of the sun's nature and character.

To illustrate and demonstrate this I notice first: that the solar rays, which in their direct line would pass *near* the earth, but would not strike it as they approach it, experience an attraction sufficient to draw them from a line into such a curve as to direct their course towards the planet, thereby concentrating upon its surface more solar influence than it would have had but for the strong mutual attraction

existing between the negative planet and positive sun.

It is upon this principle that the earth, in its revolution on its axis, concentrates upon the side receding from the sun such an aggregation of solar rays that it acts as a vast battery, driving the earth in the direction of its progress in its orbit.

Such a concentration of the positive rays on the eastern side of the earth would have a strong tendency to repel the whole earth to a greater distance from the sun; but this tendency is counterbalanced by the fact that the negative or western side is so strongly attracted as to prevent any retrocession from this cause, and is held upon a balance in the line of its orbit. Here both the diurnal and the annual motions of the earth are perpetuated and harmoniously preserved.

Another great result growing out of the positive and negative—male and female—characteristics of the sun and earth, respectively, is that whereas on the one hand the action of the positive electricity of the sun forbids the approach to, or departure from, him of any planet beyond a certain line; on the other hand,

the planets themselves all being negative or electro-magnetic, they mutually repel each other, and it is an electric impossibility for one of these planets to come in conflict with any sister planet.

On this principle, all planets having satellites revolving about them are preserved from collision. The primary planet and its satellite being both negative, and each revolving in an orbit corresponding to its magnitude, repel each other. But the question may arise, would not this repulsion drive the satellite outward from its orbit? This tendency is counteracted by magnetic attraction. Every demand involved in controlling the motions of these bodies is fully met and completely answered in the positive electricity emanating from the sun in its two-fold action of attraction and repulsion.

The male and female characteristics of positive and negative electricity, in their joint action, are more clearly seen when we consider the agency of each in giving fruitfulness to the earth, in the production and development of vegetable and animal life.

The germination of seeds when deposited

in the earth's surface, and the growth of plants, are produced by the action of "heat and moisture," as it is commonly expressed; but the real source of this heat and moisture seems to have been unknown or unnoticed by writers until the electric theory presented the true source of these agencies, and to a great extent the mode of their action.

When the rays of the sun fall upon the surface of the earth, the light of each ray is converted into heat, and hence one of these elements, heat, is directly communicated from the sun to the germinating seed, and with it an electric force to quicken the germ into life.

Light, as it falls upon the earth, is not cumulative, but is converted into heat and electricity, the two latter accumulate and impregnate the earth and atmosphere with their forces. From seed time to harvest there is a great aggregation of their powers in the lower atmosphere, where the positive electricity commingles with the magnetism of the earth, and both are thrown into a comparatively neutral state. It is from this electro-magnetic atmosphere that vegetables and animals derive their vital energies. It enters through the lungs

into the blood of animals, and through the leaves into the circulating fluid of plants. Here, then, life is generated and sustained by the joint agency of the sun and earth, and here the *motherhood* of the earth is clearly manifested under the genial warmth of the sun, "Which is as a bridegroom coming out of his chamber, and rejoiceth as a strong man to run a race. His going forth is from the end of the heaven, and his circuit unto the ends of it: and *there is nothing hid from the heat thereof.*"

MOISTURE being indispensable to growth and maturity, a wise and wonderful provision is made in nature by which the electric agencies are charged with the furnishing of this essential factor. When the upper atmosphere becomes dry and thirsty, strong currents of electricity are superinduced upon the earth corresponding to like currents of an opposite character in the atmosphere above, producing an irrepressible tendency to union on the part of the upper and lower currents, resulting in the formation over the most heated and excited parts of the earth of a "temporary low barometer." Where this occurs, there is thereby

superinduced at a distant point, generally on the polar side, "a temporary high barometer." A high barometer is a down-pour of air from the upper regions; a low being an upward pour of air greatly excited by electric action. The high barometer serves as a feeder to supply the vacuum created by the action of the low. This pair—a high and low barometer—rise in the western part of the continent and move eastward, often very rapidly. In the center of the low barometer there appears to be a vacuum, formed by a magnetic line excluding the pressure of the atmosphere. The violent upshoot through this vacuum of highly charged electric air, when passing over any large body of water, carries upward with it, in spiral form, a vast column of water to the upper regions. With this water is often drawn up a number of frogs and fish, which are frequently found on the earth after a heavy rainfall.

This volume of water, which, being from the earth, is in a negative state, now meets with violent currents of positive electricity, by which it is charged to a high degree with positive electricity, the effect of which is to separate the mass into vapor. The gravitation

of the water is overcome by the positive electricity which revolves about each atom; all being in a positive state, they mutually repel each other, and thus expand into clouds of vast dimensions, floating off and supplying the uttermost parts of the continent with rain.

Thus it will be seen that the whole process of gathering up the waters from the earth, conducting them into the aerial ocean, forming them into clouds, distributing them over the continents, and sending them down in fruitful showers, is wholly an electric process.

It is true that moderate rains are produced by the evaporation of the waters of the ocean, but it is equally true that this process is carried on by the light, heat, and electricity proceeding from the sun, and must be considered as an electric phenomenon similar in nature, but more gradual in its action, than that described above.

Now, that we have accounted for both heat and moisture on purely electric principles, we propose, by way of illustration, to apply these principles in the production of a single tree. When an acorn, for example, is deposited within the surface of the earth, and a sufficient

quantity of heat and moisture applied to the soil, the germ of the acorn is penetrated and vitalized by the magnetism of the earth, which is of a negative character. The body of the acorn, by chemical affinities, through electric agency, supplies the first nutrition, which centers in the formation of a tap root, that passes downward in a tender, pulpy form. The atoms which compose the pulpy mass, all being negative, repel each other, and lateral roots pass off in opposite directions. Each fiber of the root repels its fellow, so that every projecting fiber takes distance from the others as the space may allow, and the roots are equally distributed on all sides. By these repelling forces the roots are controlled even to their utmost development. As soon as the young roots are formed, and begin to extract nutrition from the earth, they send it to the center-point in a negative magnetic state, where it acquires a great affinity for positive electricity, and hence sends up a stem, which penetrates the superincumbent earth and peers above the surface. As soon as it emerges into the atmosphere, it meets a very dilute form of electro-magnetism, where it seizes upon and ap-

propriates all the positive electricity in its reach at that low point.

As the stem, thus strengthened, rises higher from the earth, its state still being electro-magnetic, it has not the power by repulsion from within to send out branches, until it reaches such a point in its upward progress as that positive electricity gains the predominance, when by mutual repulsion the fluid atoms repel each other, and under this influence lateral branches are sent out from the rising stem.

Through the whole of its subsequent growth the top of the plant is most positive and vital. As there is such mutual attraction between opposite electric states, longer and heavier drafts are made by the positive top on the negative roots below, and thus, by magnetic attraction, the sap is freely carried upward until the tree attains its fullest development.

The branches of the tree, now charged with positive electricity, repel each other, so as to occupy equally the space about them on the upper parts of the tree. Thus it is by magnetic and not capillary attraction that the fluids of the tree are carried to its top, not-

withstanding it may be two or three hundred feet high.

The lower limbs of a tree are never as thrifty and fruitful as those above them, for the reason that they fail to receive as full vital influence as those occupying a more elevated position, and brought more under the effects of positive electricity.

The leaves of the tree, in their thin and delicate structure, are admirably adapted to receive from the atmosphere the elements therefrom supplied, including electric and chemical qualities essential to the health and maturity of the tree.

## Chapter VIII.

### *EFFECTS OF ELECTRICITY ON MEN AND ANIMALS.*

IN the discussion of this subject we shall have occasion to allude to the action of this subtile agent in a modified form. We purpose, therefore, for the benefit of the unscientific reader, to define the terms we use.

1. Electricity proper, or positive electricity, derived from the sun, rests on the surface only of solid bodies, and is thence thrown off without a circle.

2. Electro-magnetism is a mixture of the positive and negative formed in the lower atmosphere, and is the modified form in which electricity is taken into the lungs of animals and into the circulating fluid of plants. It acts in a circle.

3. Magnetism is known as negative electricity proper, and is natural to and resides in the earth. It is also found in magnetic iron or loadstone, and may be imparted to steel or

other very hard metals, as in the magnetic needle, producing polarity. It also acts in a circuit.

4. Animal magnetism is believed to be an electric agency residing in living animals, the force of which is kept up by supplies derived from the atmosphere through the lungs and the skin, and is claimed to be the basis on which mesmerism is founded.

In all these modifications the first named, electricity proper, is the active principle.

That electricity enters into the animal economy and performs an important and indispensable part in the physiological movements of the vital organs of the body there can be no doubt, as will appear from several considerations.

1. It is known that the torpedo and electric eel, with other varieties of fish, are so highly endowed with magnetic apparatus that they use it, like a battery, to kill or shock their prey, and defend themselves from the attacks of their enemies by this power. Humboldt, in his exploration of South American waters, found the electric eel to possess this power to such a degree that horses driven into

the water to encounter them were often killed by the magnetic shock.

The electric sparks often seen upon the slightest friction from the backs of cats and other animals are too common to be denied.

2. To be more specific, we have good reason for believing that the circulation of the blood in men and animals is carried on chiefly through the attractive and repulsive forces of electricity. With every inspiration of the air a certain amount of electro-magnetism is taken into the lungs with the oxygen and nitrogen. With the blood it is immediately thrown upon the heart, which keeps that organ in a constant positive electric condition. The blood is also highly charged with positive electricity. As positive repels positive, upon the contraction of the left ventricle of the heart the blood is sent off through the aorta and arteries to the farthest extremities of the system, driven by the repelling force of the electric current within it and positive condition of the heart behind it. Arriving at the capillary division of its course, where it gives off the elements of nutrition with which it is charged, it enters the extreme branches of the veins in a nega-

tively electric state, and is therefore attracted back to the heart with the same force and speed with which it was sent out. To adopt any other theory than this, we find ourselves involved in inextricable difficulties.

It is admitted by learned physiologists that it would require a physical force of two hundred and forty pounds to drive the blood through the circulatory system with the rapidity with which it is known to pass. Now, if the blood was alone forced through the whole course of its circulation, the portal system and all, simply by the *physical force* of the heart's contraction, then certain inevitable consequences must follow; namely, the rupture of the arteries and capillaries of the whole system. The extremely delicate and attenuated condition of these ultimate branches of the system could never be able to resist the physical pressure made upon them, especially when the force applied from behind had to drive the blood not only through the delicate capillaries but beyond these still to force it on through the liver, a sponge-like formation, through which it must necessarily pass very slowly. These obstacles are too formidable to be over-

come by the mere physical force of the heart, even if the vessels were able to bear the pressure.

I have known cases where the contractile power of the heart was measurably lost, and yet the circulation was continued for years, which could not have been the case had the driving force resided in the muscular power of the heart.

The question arises, If it is not the office of the heart to drive the blood in the whole course of its circulation, then what is its function? I answer, It performs an office to the circulation similar to that the pendulum does to the clock. It measures and delivers to the aorta, in quantity and time, the blood necessary to keep up a uniform and unvarying current, measured in intervals as well as in quantity, the positively electric condition of the heart being alone the driving power on the arterial and the drawing on the venous side.

But the aid of the attraction and repulsion of electricity in the circulation of the blood is of secondary importance when compared to the influence of the same agent upon the

nervous system. On this subject Mr. Dods remarks:

"If we turn to man, and investigate the secret springs of his nature, we shall find that he is but the epitome of the universe. The chemical properties of all the various substances in existence, and in the most exact proportions, are congregated and concentrated in him, and form and constitute the very elements of his being. In the composition of his body are involved all the mineral and vegetable substances of the globe, even from the grossest matter, step by step, up to the most rarified and fine. And lastly, to finish this masterpiece of creation, the brain is invested with a living spirit. This incomprehensible spirit, like an enthroned deity, presides over and governs, through electricity as its agent, all the voluntary motions of this organized corporeal universe, while its living presence and its involuntary self-moving powers cause all the involuntary functions of life to proceed in their destined course. Hence human beings and all animated existences are subject to the electrical law that pervades the universe and moves all worlds under the super-

intendence of the powers of the Infinite Spirit.

"On this principle it will be plainly perceived that as man is subjected to the same common law that pervades the universe, so electricity is the connecting link between mind and matter. . . . It is the servant of the mind, to obey its will and execute its command. It is through electricity that the mind conveys its various impressions and emotions to others, and through this same medium receives all its impressions from the external world. It is by electricity that the mind contracts the muscles, raises the limbs, and performs all the voluntary motions of this organized body. . . . The brain is the fountain of the nervous system, from whence it sends out its millions of branches to every part of the body. Indeed, the brain is but a congeries of nerves, and is the immediate residence of the living spirit. This spirit or mind is the cause of all motion, whether that motion be voluntary or involuntary. It wills the arm to rise, and the arm immediately obeys the mandate; while the very presence of this mind in the brain, even though wrapped in the insen-

sibility of sleep, produces all the involuntary motions of the vitals and executes the functions of life."

That the nervous system adapts itself to the action of the electric current seems clear from its very structure. The electric current first being introduced into the system through the blood, the nervous centers must obtain it from that fluid in its positive form. The distribution of the nerves along the arteries seems to have this object in view. There are lines of nerves along every artery, and none along the lines of the veins, as there is no positive electricity in them. Those which accompany the arteries extract the electricity from the blood and transfer it, by induction, to the brain. This accounts, in part, for the change of the blood from the positive to the negative electric state before it enters the veins.

We shall attempt to show that electricity forms an intermediate agency between mind and matter, and is the only medium through which mind can connect itself with and control the action of the physical system.

When we come to consider the subtle and indefinable character of electricity, it is impos-

sible to class it wholly as belonging to either material or spiritual substances; but it really partakes of the nature of both and is an intermediate link between, and thus it is capable of receiving the impressions and forces of mind on the one hand, and of imparting them to the most refined and delicate parts of animated existences on the other.

The whole nervous system may be justly regarded as an electrical apparatus, receiving and distributing along its lines, by electrical agency, both the motor and sensational functions of that system. The brain, therefore, thus stimulated and vitalized by the action of the electric fluid, as a living spirit, is endowed with volition, will, and elastic action.

Mr. Dods makes the following remarks on this subject:

"Mind is the only substance in the universe that possesses inherent *motion* and living *power* as its two *primeval efficients*. These two seem to be inseparable, because there can be no manifestation of power except through motion. Hence mind is the first grand moving cause. It is the first link in the magnificent chain of existing substances. This mind wills. This

mental energy, as the creative force, is the second link, and stirs the nervous force, which is electricity. This is the third link. This electricity causes the nerves to vibrate. This is the fourth link. The vibration of the nerves contracts the fiber of the muscle. This is the fifth link. The contraction of the muscle raises the bone of the arm. This is the sixth link. And the arm raises dead matter. This is the seventh link. So it is through a chain of seven links that mind comes in contact with dead matter, if we allow the creative force, the will, to be one link; this will, however, is not a substance, but a mere energy or result of mind. To be plain, it is mind that touches electricity, electricity touches nerve, nerve touches muscle, muscle touches bone, and bone raises dead matter. It is, therefore, through this concentration or chain, link by link, that the mind gives motion to and controls living or dead matter, and not by direct contact with all substances. Hence the proof is clear and positive that the mind can come in contact with and by its volition control the electricity of the body, and collect the subtle agent with fearful power upon any part of the system.

"It is evident that the mind holds its residence in the brain, and that it is not diffused over rhe whole system. Were it not so then our hands and feet would think, and in case they were amputated we should lose part of our mind. If, then, the mind, invested with royalty, is enthroned in the brain, and if the mind commands the foot to move or the hand to rise, then it must start forth from its presence an agent, as its prime minister, to execute this command. This prime minister is electricity, which passes from the brain through the nerves as so many telegraphic wires, to give motion to the extremities. On this principle, how easy it is to understand the philosophy of a paralysis! The nerve, as the grand conductor of the motive power, is obstructed by some spasmodic collapse, and the prime minister can not pass the barrier that obstructs its path. In this case the mind, as the enthroned monarch, may will the arm to rise, but the arm remains motionless, but remove that barrier, the agent passes and the arm must rise. Hence it is easily seen that all motion and power originate in mind.

"I have now brought before you the connecting link between mind and matter, and through this have shown you the philosophy of the contraction of the human muscle through mental energy. This has ever been, and still is, considered an inscrutable mystery in physiology. . . . I have already stated that the brain is the fountain of the nervous system, and that both its hemispheres are a congeries of nerves. They both pass to the cerebellum; and the spinal marrow continued to the bottom of the trunk is but the brain continued. In the spinal marrow, which is the grand conductor from the brain, is lodged the whole strength of the system. From this spinal marrow branch out thirty-two pairs of nerves, embracing the nerves of motion and those of sensation. From these branch out others, and others again from these, and so on until they are spread out over the human system in network so infinitely fine that we can not put down the point of a needle without feeling it—and we can not feel unless we touch a nerve. We see, therefore, how inconceivably fine the nervous system is. In all these millions of nerves there is no blood. They contain the

electric fluid only, while the blood is confined to the arteries and veins. I am well aware that blood vessels pass around among the convolutions of the brain, and through them the blood flows freely to give that mighty organ action; but in the nerves themselves there is no blood. They are the residence of the living mind, and its prime agent, the electric fluid."

The effects of electricity upon different persons is not always the same. Those of delicate form and of nervo-sanguinary temperaments can not bear as much as those of bilio-lymphatic temperaments. I published an article in the *Family Visitor*, in Houston, some years ago, on this subject, which, being read by a minister of the nervo-sanguine temperament, he wrote me on the subject, and said: "I have read and believe in your theory on electricity; but there is one question I should like to ask you. It is this: What is the reason that I can not sleep at night if my body lies north and south, as well as when I lie east and west?"

The following answer was given through the same paper: "When you lie north and

south there is a current of electricity passing around your body, which creates a polarity; and if your head is to the north, there is an accumulation of positive electricity upon your brain which renders it too active for repose in sleep."

When this answer was read by a friend by my side, he said: "That answer may be true, as it applies to Rev. Mr. H.; but what will you say when I tell you that I can not sleep unless my head *is to the north* and my feet to the south?"

"O! that is all plain enough," said I; "Mr. H. is of delicate form, with sanguinary nervous temperament, while you are strong and muscular. He can not bear a strong current on his brain, while you have a dark, bilious, lymphatic temperament, thick skin, and dark hair; you require the excess of electricity to raise your brain to the equilibrium of quiet repose."

The gentleman said that he had slept with his head to the north for twenty years without knowing what made the difference.

In a standing position, with the feet upon the ground, a large share of magnetism passes

off into the earth. The position of the head being the highest part, is favorable for receiving and retaining the fluid upon the brain. When the feet are well protected by good non-conducting clothing, as woolen socks, the escape is not so rapid. We have met with the history of some cases, where, upon woolen carpets, ladies of delicate, nervous temperaments have naturally accumulated electricity in such excess that sparks would be emitted upon approaching one in a negative state.

To the above may be added the following: A few evenings ago I enjoyed a visit from Dr. Van Antwerp, a very scientific gentleman of this place. When this subject came up he remarked that he had frequently accumulated so much electricity upon his person by simply passing a few times, with a sliding motion of his feet, across a room covered with a woolen carpet that he could light a gas jet by simply pointing his finger to it.

There can be no doubt of the fact that good health and comfort is more the result of keeping the system in a favorable and uniform electric condition than is generally supposed, and that disease is often superinduced from

sudden changes in the electric condition more than exposure to heat and cold.

Dwelling-houses are known to be more comfortable and healthy when set up a few feet from the ground than those which are placed so near the earth as to carry off the electricity by dampness and negatively electric character. A woolen carpet as a non-conductor is also of great advantage.

It will be readily seen from the number of facts and principles now brought before the reader that electricity is so intimately blended with the mind, in the process of thought and action, that the mind depends upon it in the exercise of its functions. In the light of this fact we may logically conclude that the inspiration of electricity upon the brain and nervous system is an indispensable element in the development of superior talent and mental power. It is true that it requires a large and well-balanced brain, a fine development of the whole physical system, to furnish a flow of vigorous, healthy blood upon the brain to develop its full powers; a favorable temperament, properly modified by the combination of a due admixture of the nervous, sanguine, and bilious;

but where all these are present and in good condition, yet to fire the whole spirit with the animation and enthusiasm necessary to an extraordinary mental force, a large endowment of the electric inspiration is indispensable. An aspiring, able, and well qualified orator, in the preparation of his address, has before his mind's eye a large and intelligent auditory, one that excites his energies and summons all his powers to rally for the occasion. Among the first of these forces is that of electricity, which is summoned by the outreaching of the mind for it, and the affinity thereby created for its presence and action; the supply is always equal to the demand if the proper conditions exist. Men who duly appreciate these aids and benefits do not hesitate to throw open the gates of the soul and admit the ethereal elements.

We have aimed to show the influences of electricity upon the physical organism of men and animals, as well as upon the mind; but *animal magnetism* contemplates much more than this, and demands a notice in this connection.

Animal magnetism is defined to be an in-

fluence analogous to terrestrial and metallic magnetism, supposed to reside in animal bodies, and to be capable of transmission from one to another.

It was first brought into notice in Germany, in 1775, by Mesmer, a native of Swabia, who had graduated in medicine at Vienna, nine years before. He regarded this new force, which he said could be exerted by one living organism upon another, as a means of alleviating or curing disease. In 1778 he removed to Paris, where he established an institution for the cure of diseases by this method.

Mesmer gives his views as to the operation of this magnetism, as follows: 1. There exists a mutual influence between the celestial bodies, the earth, and animated beings. 2. This reciprocal action is regulated by mechanical laws, which, up to that time, had been unknown. 3. Animal bodies are susceptible to the influence of this agent; and they are affected by it, on account of its disseminating itself through the substance of the nerves.

Like every other science, this new discovery was ridiculed by some professional gentlemen in Paris, and the Academy of Science

ordered an investigation to be made by a commission from their body, of which Dr. Franklin, then in Paris, was the head. That commission reported that they found no evidence to sustain the doctrines of the science. Subsequently the science revived under some discoveries made by the marquis de Puységur, in which somnambulism was introduced as a part of the mysterious magnetic influence. Mesmerism, as this science is called, has been so long practiced in this country, and is so well understood, that a further investigation of its principles and powers is scarcely necessary. Suffice it to say, the power of practical mesmerism is possessed by but few persons, and fortunately so, as it is susceptible of great abuses.

Man, in the spirit and essence of his being, is almost wholly spiritual. In other words, the mind, with its residence, the brain and nervous system, is *the* man. All else in his organism are merely the carriers and servants of this inner and real man. This being true, how natural and necessary that this inner spiritual personage should be so endowed, while yet in the body, as to hold some control and

dominion over subjects that border upon the spirit world. Does not his spiritual organism indicate such a power?

Though our remarks on this subject thus far have been confined to nature and natural laws, yet, under the light of revelation, man is associated with a purely spiritual God, and by the provisions of the Gospel, through the Lord Jesus Christ, he is destined to rise above all natural things, and by casting off this mortal coil, enter into a spiritual body more perfectly adapted to the enjoyment of spiritual life and endless bliss. In view of these great spiritual truths, is it to be thought a strange and unaccountable thing that the imprisoned spirit in mortal flesh should occasionally manifest the powers of its superior nature, and thereby rise to such heights in spiritual developments as to pass the limits of nature's laws, and the comprehension of the students of material things?

Christianity meets man on his pilgrimage through the toils and darkness of his *natural* life, and recognizes him as a son of immortality, and points his feet to the pathway that leads him to the light of the knowledge of the

glory of God as seen in the face of Jesus Christ. Inspired with this light, the imprisoned spirit is no longer content to walk by the light of nature, but drawing largely from the resources of the higher spiritual life, he enters upon new relations to the Father of his spirit, and the discharge of those duties that grow out of his new relations.

In this superior spiritual life he finds every demand of his immortal being fully met, as nature can not meet it, and rises to knowledge and immortal bliss, unspeakable and full of joy.

## Chapter IX.

*ANIMAL MAGNETISM—WHY THIS AND LIKE CHAPTERS ARE INTRODUCED—MAGNETISM IN ORATORY—MAGNETISM BETWEEN THE SEXES.*

ALTHOUGH the preceding chapter and the one here presented may have no immediate connection with electric astronomy, they are here introduced for the purpose of showing that the same great laws of electric attraction and repulsion, which are found to control the motions of all the heavenly bodies may be easily traced in carrying out and giving perfection in every subordinate form of existence, even to the impartation of vitality in germ life, growth, and development in both the animal and the vegetable kingdoms; and beyond these limits they are found to exercise a dominant control over the heart and mind of conscious intelligences in giving direction to the affections, and in largely contributing to the formation of character on the basis of social and domestic life and happiness.

It will be perceived that where there is a very large endowment of animal magnetism bestowed upon those who have to deal with the public mind as orators, it tends to inspire the mind with great animation and enthusiasm as the speaker warms up with his subject, producing eloquence and pathos, and it serves as a connecting medium between the speaker and hearers, especially of those who have a like endowment, giving to such speakers a power of persuasion and a success which far transcends that of other orators less endowed with this element, although the latter class may excel the former in learning and intellectual ability. The sympathetic chord naturally vibrates to the delicate touches of this mysterious agent, and herein we may find the secret of success in the art of persuasion.

The discoveries made by Mesmer in 1775, alluded to in a preceding chapter, as used by him as a remedial agent in curing diseases, first brought this mysterious power into public notice. Since that time the subject has attracted much attention, and investigation has brought the subject into practical use in many ways not contemplated by Mesmer.

The laws of electric action were not well understood in Mesmer's day, but when he says "it disseminates itself through the substance of the nerves," he does not tell us how or by what means. It is now well known that the nervous system in men and animals forms the medium by which electro-magnetic forces are carried throughout the body, and it is through this medium that both the nerves of motion and sensation are greatly excited in action, as seen in a former chapter.

My own reflections have conducted me to the following conclusions: Animal magnetism is a peculiar form of electro-magnetism, which resides in men and animals, not identical with any other form. The singular power of one mind over another, and of mind over matter, has been considered; but the magnetic relations between the sexes form another and more interesting feature of the subject.

As the sun is positively electric to the earth, and the earth negatively electric to the sun, these opposite conditions and natures have induced electricians to call the sun the male and the earth the female in their relations to each other; for it is their mutual action, one

upon the other, that gives fruitfulness and vitality to the earth.

So man in his relations to woman is electrically positive, and woman electrically negative to man. The electric bond in this case is found to reside in animal magnetism. The effect of this relation is to produce a strong mutual attraction between them. This attraction is recognized in the very tender regards held by the one towards the other. Woman is as perfectly the counterpart of man as the earth is of the sun; and they are mutually dependent, one upon the other, in fulfilling the wise and gracious purpose of their Creator.

Like all other subordinate passions, inclinations, or affinities, this electric affinity is intended by the Creator to be held under the restraints of the intellectual and moral elements of the soul, and when so held it contributes an immeasurable degree of happiness to the parties concerned. When the intellectual and moral powers are highly cultivated they preside with great ease and harmony over all other forces pertaining to the animal economy; and hence, where this electric force is trained and cultivated in a chaste and pure

manner to perform all the functions assigned it, there is nothing in human nature that tends more to the elevation and purity of the mind and affections than the bonds of sexual love. It forms the bonds of social and domestic life, exalting pursuits of the mind and the culture of the heart to a purity and chastity unattainable from any other cause in nature.

The affinities created by this subtile and active force in nature find their consummate bliss in the union and oneness found in the holy bonds of matrimony. Here a permanent basis is laid in nature, which, if properly cared for and maintained, insures the parties concerned a harmony, peace, and unalloyed pleasure which could not arise in the same permanent and enduring form from any other elements found to exist in common between the parties. The same permanent law of affinities is firmly laid in the constitution and elements of all the lower animals, which secures between them a tenderness for the sex and their offspring, a protection and safety from a thousand ills that would exist among them, but for this wise and gracious provision grounded in their nature.

To demonstrate practically the power of this force between the sexes, it is only necessary to observe the temper, manner, and delighted emotions manifested on both sides where refined ladies and gentlemen are thrown into company, and enter into social pleasures. There is a degree of animation, an exquisite delight, that could never be found to the same degree in an assemblage of the same number of either of the sexes in the absence of the opposite. This force is intensified where the sexes are brought into near proximity, as in the dance, especially the round dance, which so inspires the circles of pleasure that entire nights spent in the convivial circle fail to overcome or subdue the pleasures of the occasion.

In social circles where the intellectual and moral culture have been neglected, the sexual affinities not sufficiently restrained, then this tender and delicate attraction may assume the mastery, and deleterious results to society follow; for the greatest blessings bestowed upon our race by the Great Giver of all good may be abused, and that which was intended to promote our virtues become the occasion of vice.

No element or power pertaining to human

character and animal life could so universally assert its force, and for so great a length of time hold dominion over the lives and characters of men or animals, unless it had its foundation in a great law of nature. This law is found in the mystical and semi-spiritual elements of animal magnetism.

Between the sexes the affinity or attraction, though universal, is not always the same between particular individuals; for the taste, fancy, and culture of individuals are so widely different in different persons that these have to be consulted and their demands considered before there can be a free commingling and association of sentiment and affection. The combinations of character in different persons are so vastly diversified that the most fastidious will have often to travel far and wait long before the real counterpart is discovered; but this does not vary the principles which lie at the basis and form the foundation of social union.

Parental tenderness and affection is rooted in and springs from the same magnetic source. The ties established in domestic and social life have their origin in this force.

All persons are not equally endowed with animal magnetism. While some possess it in a very high and active degree, so much so that they exert a greater power than others over the hearts and minds of their associates, whether in social life, or as orators before an assembled multitude arresting and holding under their control the minds of the masses, others possess it in a very feeble degree, and therefore they fail to exert the same persuasive and controlling force over others. This may account in some degree for the great difference found to exist in these respects between different persons.

The laws of attraction and repulsion, or of affinities, may be said to exist in the essence and nature of God himself, only of a very superior and divine character. God is love; and this divine principle seeks to manifest itself in bestowing physical and spiritual bliss on all the moral and intelligent beings of the universe. They are attracted or repelled according to the states and conditions of the moral elements of their being. As God is the great moral governor of the universe, his government is purely moral and spiritual; and

hence there is nothing arbitrary, compulsory, or despotic in it. This law and government takes cognizance of the mental and spiritual elements of our nature, and when these are exalted into an intimate communion with God they partake of the divine nature in a supernatural degree, and that nature is love.

That electricity may even have some important office to perform in bringing about such a result may be inferred from our remarks on the influence of mind over matter, as seen in a former chapter. God's government over man is purely spiritual, and he holds a very intimate connection over the action of every pure and holy mind, under a boundless resource of appliances. We can not undertake to say what agencies he may choose to employ in accomplishing his great beneficent designs; but as man in his primitive perfection was so formed as to hold a vital connection with the earth as his lordly heritage, so God, the center and soul of the universe, may hold a vital connection with his spiritual universe, where every subject is a partaker of his divine nature. It is certain that it is in him that we live, move, and have our spiritual being.

## Chapter X.

*CLOUDS, LIGHTNING AND RAIN—CRYSTALLIZATION.*

NOTWITHSTANDING the subject of this chapter properly belongs to the science of meteorology, yet such is the intimate connection existing between the laws and principles upon which the two sciences, electric astronomy and meteorology, are based that this may be regarded as common ground, in which both have an interest, and an investigation of underlying principles will throw light on both sides of the line, and show a beautiful harmony between the two.

Indeed, the dominion of the electric science is universal, not only compassing all celestial and terrestrial orbs, but even entering into the life and action of the animal and vegetable kingdoms, as shown in the preceding chapter. Hence, to further show the universal prevalence of the electric agency, it is quite legitmate to treat of it here to a limited degree.

We first consider the lightning, which, in some form or another, carries on an intercourse between the sun and earth. To understand this subject correctly it must be borne in mind that every ray of light that proceeds from the sun is perfectly possessed of every element that enters into and forms a "streak of lightning." The difference is this:

The ray of light from the sun is composed of light, heat, and electricity—the lightning possessing the same. The sun is of a globular form; the rays which pass off from its rounded surface, each moving in a direct line perpendicular to the surface from which it starts, diverge from each other according to the squares of the distance from the sun to the earth—92,000,000 miles—consequently they are so separated and scattered that their number and force are greatly diminished as compared with the point of departure.

The lightnings are formed by the descending rays falling upon intervening clouds, where they are absorbed or retained until they accumulate in great force. Where there are a number of clouds in the upper atmosphere, one above another, the highest receives the

heaviest charge. The cloud next below it, not so heavily charged when coming in striking distance, receives a discharge from the one above through a short intervening space of cloudless atmosphere. In passing through this space it violently rends the air, producing a perfect vacuum in the line of its passage, which is so violently closed again, when the current has passed, that this violent concussion in the air produces the sound we call thunder—just as the like sound is produced by the discharge of a cannon or gun.

Where there is still an underlying cloud not so heavily charged as the one above it, it receives a like discharge from its overlying neighbor, which again sends its discharge upon the earth beneath it.

Wherever there is an accumulation of positive electricity in the clouds above, in any locality, there will be also a corresponding charge of the negative directly under it, seeking to unite with it. As it can not rise beyond the point where it finds a conducting medium, it will climb to the highest point leading in that direction; hence it ascends mountains, houses, and tall trees, and even

rises upon the lightning-rods placed upon houses, to intercept the falling currents from above, where it may be seen as a bluish white light during a storm, dazzling on the high points.

When the accumulation of both kinds is sufficient to produce a storm, and there has been no discharge upon the earth from above, then the two forces unite in forming a cyclonal vortex—a whirling column, with the lower end or pole upon the earth, and upper reaching to the cloud above, which forms a conductor, when a heavy column of negative electricity shoots up upon it with great violence, carrying with it water—if over water—or any thing else which happens to fall within the vortex.

This cyclonal vortex seems to be formed in the following manner: An electric center of negative electricity being formed on some high point on the earth, with a rising point, superinduces a positively electric center in the cloud above; the point drawn toward the negative below, they unite their forces in forming a magnetic line from one to the other, which is composed of oxygen or hydrogen gas. So soon

as this line is formed it expels the atmosphere on all sides around it, producing a vacuum, which forms the cyclonal vortex.

The rising current of the negative electricity passes around this magnetic line in a spiral form, and shoots upward, until it unites with the positive; and the two kinds mingle in a neutral state, robbing the cloud of its destructive energy, when the upward spiral shoot of negative electricity occurs, which is of a bluish white color. When seen at a distance it always presents a zigzag line, resembling the view presented by a corkscrew when seen from the side. It is often the case, however, that the upper or positive electricity descends through the spiral vortex, and unites with the negative below. In either case the acting current takes the dynamic form, and the inducing pole is in the static.

Lightnings appear in various other forms, as sheet lightning, in their vapory clouds; but ordinarily these are not productive of storms.

These cyclonal vortexes form what are called temporary low barometers, which travel at various speeds from west to east at the rate of

from ten to fifty miles an hour. Into the base of these the atmosphere is drawn in rapid currents from all directions around, and passing up through the vortex, is thrown upon the surface of the aerial ocean, carrying with it the lower stratum of atmosphere charged with the exhalations of the earth, heated air, and malaria, where all impurities are eliminated; when it floats to the summit of a high barometer, and again descends in a pure state to the surface of the earth.

These cyclonal tubes may continue for a length of time while they are in rapid motion over the surface of the earth. When in operation the atmospheric air is carried up so forcibly that a very low barometer is produced at the center, and the winds from all directions will rush with great violence to fill up the vacuum produced by the up-rising air. The wind does not produce the storm, but the electric storm produces the current of wind. The winds may thus be set in motion for hundreds of miles around the central point. Calm and clear weather results from an equilibrium in the electric condition of the atmosphere. Electric disturbances may occur from astronomic

causes. The passage of the sun across the earth's equator, or the passage of some of the smaller planets across a part of the earth's orbit, are to be regarded as such.

From the foregoing, and many other like facts shown in this work, it will be readily perceived that light, heat, and electricity—THE TRINITY IN UNITY—is the great all-pervading force that gives vitality and action to every thing that lives or moves in the entire universe!

In itself it is imponderable, and can not be acted upon by any physical force known; and yet it acts upon and controls the rolling worlds around us, and enters into and regulates the most minute parts of the earth—animal and vegetable bodies—and even aids the mind in the discharge of its functions.

The temporary low barometer forms but a part of the great machinery of nature for keeping up a controlling influence over the currents and motions of the atmosphere necessary to keep up and perpetuate the great vital and sanitary functions of nature. There is a system of permanent high and low barometers which are very extensive in their office and

action. The principal low barometers take their positions along the equatorial line, over the surfaces of all the oceans falling within their range. And also a large circular low barometer at each of the poles, and a permanent low barometer located in Iceland.

The permanent high barometers are found on the oceans at 23½° from the equator, or on the dividing lines between the torrid and temperate zones. The winds flowing from these high barometers southward in the Northern Hemisphere flow in a south-west direction, and pass into the elongated low barometer on the equator. Those which descend from the permanent high barometer in the Southern Hemisphere on the equatorial side flow in a north-west direction to the base of the same central low barometer, forming the permanent trade-winds. The winds which descend from the permanent high barometers in the Northern Hemisphere on the north side generally flow out in a north-east direction, and when not interrupted by a temporary low barometer they pass off to the permanent low barometer in Iceland or the Boreal Pole. Those that arise from a permanent high barometer in the

Southern Hemisphere, on their south side, flow in a south-easterly direction, and ultimately reach the South Pole low barometer. These regular currents are often diverted from their course by periodic and temporary low barometers, which often occur on their passage north or south.

There are also what are called periodic high and low barometers, which change their position every six months. In our Summer a high periodic barometer, which is in Central Asia, lifts, and a low barometer takes its place; this high then takes the place of the low which was in South Africa, in the Southern Hemisphere. When the sun, in Autumn, crosses the equator to the south, they again exchange places, and so on forever. (For a more full and perfect knowledge of this subject see Professor Tice's "Treatise on Electric Meteorology.")

The atmosphere can only receive the power to gather up the waters of our rivers, lakes, and seas, to form the clouds that water the earth and give it fruitfulness by electric agency. When the positive has heavily charged the clouds, or gathered in force in the upper at-

mosphere, it superinduces the negative to form in like force on the earth, or *vice versa.* When these forces approach each other, by their joint action they form a magnetic line of magnetized oxygen or hydrogen gas, which extends from the negative force on the earth to the positive in the heavens, around which an up-spurt of negative electricity passes, carrying with it, when formed over water, an upward water-spout, which is dispersed as vapor and formed into clouds. This magnetic line and vortex or tube forms a conducting medium for the passage of the electric current. It sometimes occurs that a cloud, heavily charged with positive electricity, forms such a vortex, with a like heavy charge of the negative kind, and when the up-shoot of the negative occurs, it neutralizes the positive cloud and robs it of its energy.

This equalizing process between the two kinds of electricity is a great conservative arrangement by which lightnings are rendered harmless, and the atmosphere is modified and settled down into a quiet, calm, and clear condition.

The negative electricity of the earth, as

Professor Tice believes, is the prime agent in producing earthquakes and volcanoes when it is severely agitated. It is certainly the agency by which mineral crystallization is carried on in the earth.

The law of crystallization is this: The ultimate atoms of all crystals, in their formative states, are polarized. Polarization can only take place under the action of electro-magnetic agency. The polarized atoms, by the affinities peculiar to each variety, arrange and adjust themselves by electric currents into the positions necessary to form the crystal peculiar to its kind.

The first fact that arrested my attention on this subject I met with in the lead mines near Galena, Illinois. There I found that all the mineral deposits found in place were found in the crevices of the rocks either running east and west or those running north and south. All the deposits found in the east and west crevices were regularly formed into cube crystal, while those found in the north and south crevices were not in crystalline form at all. How to account for this difference was the question. The electric theory explains it. The

belt or current of electricity passing rapidly around the earth from east to west passed along the line of the deposits running in that direction, and polarized the atoms, and therefore crystallized them; while the same current only crossed over the lines running north and south, and they were not crystallized, but left in an irregular granular state.

If the electric polarity doctrine does not furnish the true law by which mineral crystals are formed, will the objector furnish one more rational and scientific?

It is held that the polar light is polarized in the atomic form (which is the effect of the electricity combined with it), and why not allow the same principle to pervade all atoms?

The limits of our plan will not permit us to go into further details on this subject here.

## Chapter XI.

*EFFECTS OF ELECTRICITY ON THE GERMINATION OF SEEDS AND THE GROWTH AND DEVELOPMENT OF PLANTS.*

BUT for the vital and active energy of the electric current the atmosphere would be as stagnant and motionless as the water in a stagnant pond, and therefore be devoid of those active and vital elements which give vigor and life to growing plants.

All trees and plants live and grow in the open air, and must be dependent upon it for all the elements of life necessary to their development. The earth, it is true, supplies moisture and nutrition, but that moisture is supplied by the rains produced by the clouds and rains superinduced by electric agency. The earth would be wholly barren of vegetation but for the supplies derived from the atmosphere, which is wholly under the control of electricity.

We shall find little difficulty in showing

that electricity is indispensable to the germination and growth of plants. From a scientific work before us we extract this statement:

"Some seeds and plants will germinate and sprout at a temperature but a little above the freezing point; but Indian corn requires a temperature of 48° Fahr., but acts most vigorously at a temperature of 93°, and will tolerate a temperature of 115°."

This statement is made upon the old theory that heat and moisture alone are necessary to the germination and growth of plants. Now, we ask, where can the advocates of that theory procure solar heat without the agency of electricity? Where does the moisture come from except through the atmosphere, which is wholly under the control of electricity? Both heat and moisture are the results of electric action on the atmosphere.

It has been shown that the earth itself is so far under the influence of electricity that its revolutions upon its axis and in its orbit, as well as the inclination of the poles, which controls the seasons, are the results of the all-controlling forces of positive and negative electricity, and that, therefore, we should not

have Winter and Summer but for this all-pervading agency.

Light, heat, and electricity are combined in every ray of the sun that reaches our earth. They may pass through cold and frigid regions of space without producing any marked changes; but so soon as they fall upon the surface of the earth or circumjacent clouds, they become active, and in one or more of their elementary constituents control the temperature of the air, give warmth to the soil, and moisture and fruitfulness to the earth.

To illustrate more fully the action of the electric current upon the growth and development of plants we have taken as an example, in a former chapter, a tree of any of the varieties that grow to any considerable height. The first thing to be noted and kept in mind is that the earth is in a negative state of electricity, and that the air is in a positive state as compared with the earth. The roots of the tree, therefore, are within and under the control of negative electricity. Under the action of this force every root, however small when first put forth, will be sent off in such a direction as to avoid contact with every other root,

for the law of mutual repulsion between negatives is as active as the law of mutual repulsion between positives. By this law the roots are equally distributed under the surface of the earth, the better to draw nutrition from every part, and the better to firmly sustain the tree in its erect position.

The nutrition drawn from the earth, in a fluid state, is drawn to the rising stem of the tree, for it is in a negatively electric state, and is thus drawn to a central point for the reason that the current is made to take that direction by the attraction produced in the upper parts of the tree, where positive electricity predominates, for positive will attract negatively electric bodies or fluids.

Where the positive and negative are nearly equal in force, as from the surface of the earth to the first limbs, it puts out neither roots nor branches; but when the ascending sap or fluid rises sufficiently high to receive the action of the atmosphere it passes from the negative to the positive state, when the atoms or molecules mutually repel each other and incline them to take opposite directions, and hence the tree throws out branches in accordance

with this law, and the central positive forces drive the circulation out to the extremities of the branches in all directions. The top of the tree, being higher than all other parts, is in a more positive state than the lower branches, and hence, relatively, they are negative to it, and therefore yield up a part of the current supply to its superior demands. Thus the top of the tree is the most vital part.

The leaves of the tree perform an important part in receiving the circulating fluid; and passing it through their numerous pores expose it to the action of the sun and air, from which it absorbs the necessary oxygen and carbon, and return it to the general circulation, performing a similar office to that of the lungs in the animal economy.

This theory in regard to the agency of electricity in carrying on the vital process in trees and plants is new. I have neither seen nor heard any thing on the subject up to this time from any one; but the process set forth above to me seemed so natural and so much in harmony with the general electric theory that I have ventured to set it forth to public view, to be criticised and approved or condemned by

those who are more skilled in the doctrines and principles involved than I am. At any rate, we shall adhere to this theory until a better or more rational one shall be presented.

We object to the old idea that the sap is carried to the tops of the highest trees by capillary attraction. Such an attraction, if there is any, is very feeble, and can not carry a fluid higher than a suction-pump, which is about thirty-three feet, while the tallest trees reach up three or four times that distance.

The old theory assigns no reason for the equal distribution of the branches of the tree at all, while the electric theory gives the only rational view of the subject. The upper part of the tree being in a positive electric state, every limb repels every other, so that the space is equally occupied on all sides. The same law regulates the position occupied by each, where many trees grow up near each other. The mutual repulsion between them causes some to lean away from others to find room in which to spread. The common opinion is that the leaning tree seeks for more light; but suppose this to be true, what is light but a part of electricity? It is never

separate from it in the open air, as solar light.

What is said of trees may be applied to every growing plant, with very slight modifications. The life germ in plants and the living, conscious spirit in men and animals originates with God alone. No science can originate a single plant or animal except through the laws of propagation implanted in the varieties and species belonging to each; science has ample employment in searching after the hidden secrets of nature, and in studying the laws by which God, in his wisdom, chooses to renew and sustain nature in all parts, mineral, vegetable, and animal.

These laws should be studied and understood by every man, but more especially by every Christian, as they go very far towards making God known as revealed in his works, and enable him to better understand his true character as revealed in his Word.

Every step made in the direction that develops truth is a step towards God.

## Chapter XII.

*DIFFICULTIES IN THE WAY OF THE INTRODUCTION OF A NEW THEORY OF ASTRONOMY.*

IT must be borne in mind by the reader that the subject of this work first engaged the attention of the author in the year 1834, more than fifty years ago, as has been seen in the preface, and that from time to time a part of the theory was given to the public for the purpose of eliciting investigation and criticism, and that finally the subject was brought before the readers of Wilford's *Microcosm*, where a mere outline view was presented, sufficient, however, to give to the readers of that paper, if so disposed, an opportunity to call in question the correctness of the doctrines and principles presented.

There were, however, no objections urged, except by the editor. The substance of these criticisms will be embodied and answered in a succeeding chapter.

To revolutionize the opinions of the enlightened world and the doctrines of the schools is a work of time and patience which the history of the changes in all past ages demonstrates to be exceedingly difficult. Copernicus, after living seventy years, and having devoted his active life in laboring to overturn the Ptolemaic theory (which had dominated the public mind for centuries), *i. e.*, that the earth was the center of the universe, and that the sun, moon, and stars revolved around it, after seeing the first copy of his able work setting forth the present system, died, in 1543, without having made a single noted convert to his doctrines. Twenty-eight years and seven months after his death his first noted disciple was born, Johann Kepler, who, after arriving at mature years, espoused the cause of Copernicus. He, with the aid of Galileo, of Italy, succeeded in rescuing the work of Copernicus from oblivion, and establishing the science of astronomy upon the basis on which it now stands. Galileo survived Kepler twelve years, and died in 1642. These heroes in the battle for science were not only slow in making converts, but brought upon

themselves the severest persecution, the latter forfeiting his liberty and almost his life in vindicating the truth as revealed by Copernicus. Thus a battle raging for ninety-nine years was waged against the truth before the lights of science could dispel the prejudices of education.

With these examples before me I must learn the lesson of patience, and wait until a generation passes, when it is hoped that the republic of letters will be able to resist the powers of great names and long established opinions, and give due weight and authority to *truth*, though it may have been discovered and brought to light by an obscure and unpretending member of the brotherhood of man. Hence I am content to place the result of my reflections and investigations upon record, and wait the arbitrament of Time to do justice to my humble labors; yet hundreds have already assented to the truth of the theory.

The process by which I have been conducted by slow progressive steps has been prosecuted with an eye to the following great facts: I lay it down as a foundation principle that all *truth* originates with God, and forms

not only the basis of every virtue, but is the foundation upon which all true science must rest.

Truth is an essential attribute of the divine nature. Every truth in the universe of necessity must be in harmony with every other truth; and hence no two truths in nature, revelation, or science can be found to antagonize each other.

Upon this basis I have most diligently sought for a knowledge of truth, and wherever found to be positively demonstrated I have embraced it as a treasure, and under the light of each newly discovered truth have sought to harmonize one with another, and step by step they have brought new discoveries to light, and thus progressively a new system is developed, as in the case of the electric theory, where the whole symmetric outline is compassed, and a system more grand and perfect could never have been conceived by the most extravagant exercise of the imagination.

Within this system we find the following principle to be correct: Where the great fundamental pillars of truth clearly and unquestionably stand secure, any intermediate

truths not so well established receive great strength and support when it is found that they are in perfect harmony with the great frame-work of the system. For this reason, though treating chiefly of the solar system, and demonstrating the attracting and repelling forces of electricity to be the agents by which the solar bodies are propelled in their diurnal and annual revolutions, we follow the ultimate action of these vital agents in their influence in the production of vegetable and animal life, the circulation of the blood in animals, and the rise of the fluid in plants, and are thus led to the conclusion that in the most minute parts of the material universe these all-pervading agencies permeate the whole, and give life, law, and action to every part.

Indeed, we need not stop here; for does not the electric medium bridge the chasm between the physical and the spiritual? When we consider the organism and structure of the delicate nervous system in man, where, if anywhere, a union is formed between mind and matter, it is clear that electricity is the link by which mind transfers the force of action into matter. If this is not correct, we are un-

able to conceive by what other method such union can be formed. That mind *does* govern matter is a proposition nowhere denied.

In the light of the principles recited above, it is clear that God is the source of all truth, both in religion and science. Then there is an inseparable connection between the two; hence, as a Christian minister, I am bound to recognize it as a duty to vindicate God's truth—both in the revelation of his Word and of his works.

The study of God in his works is a Christian duty. If, by indifference or indolence, this duty is neglected, the soul is robbed of many rich jewels of truth and knowledge, which, if possessed, would adorn and beautify the palaces of the soul where God proposes to dwell. Next to God himself, MAN in Christ holds the highest rank in the scale of being of which we have any knowledge. Whether we test this high rank by testimony of nature or revelation, the decision will sustain this high position. By nature he is recognized as lord of earth. By revelation he is declared to be the son of God and a joint heir with Christ to a throne and dominion in

heaven, unto whom the angels become ministering spirits.

To confer honors, dominion, and treasures upon man, corresponding to his rank, God created the world expressly for him, and adapted all its parts to subserve his interest, nature, and enjoyment.

Could there be a richer field opened to his view than the survey of his dominions and possessions? Should he not measure the force of obligation he owes to himself and his Father God by the high rank given him in the scale of being? If these high considerations do not inspire him to the effort to gain the knowledge and fitness for his high rank, what can inspire or move him in that direction? The danger is that the *greed for selfish gain* will so besot the mind and corrupt the whole soul that his vast heritage will be sold out for the lustful pleasures of a day, and the heirship to his lordly heritage will be forever lost.

Though many high-born heirs to imperishable honors and dominion have been cheated out of their rightful heritage by the sensualities of present pleasures of a low, debasing kind, yet, thank Heaven, all are not thus de-

ceived and blinded, but some are inspired by love of truth and all those purer principles which adorn and give vigor to the aspiring mind, and these, though few they be, will turn aside from the follies of their associates, and seek that substantial knowledge to be found in the great treasury of nature and nature's God that will endure through the endless cycles of the future. It is to aid and encourage the chosen few that will think and read and get true knowledge that we labor.

Now that this theory is completed as far as it is practicable at present, it is respectfully submitted to the calm and impartial consideration of the intelligent reader. It is not claimed to be perfect in all respects, for doubtless there will be other and great discoveries made which will add to its perfection.

If I have succeeded in nothing more, I shall be content with the reflection that I have brought before my readers a great and comprehensive theory based upon cardinal truths and principles found in Nature, the consideration of which will give pleasing employment to all lovers of truth as revealed in the machinery of the celestial and terrestrial members of the solar system.

## Chapter XIII.

*OBJECTIONS TO THE ELECTRIC THEORY MADE BY DR. HALL IN THE MICROCOSM NOTED AND ANSWERED.*

BEFORE presenting my theory in book form before the public it occurred to me that it would be good policy to set forth the cardinal doctrines and principles on which it is based in the pages of some popular scientific journal, the better to enable scientists to survey and criticise the ground we occupy. This was done in the second volume of the *Microcosm*, our intention being that, if our positions were untenable, and our conclusions not correct as drawn from the premises, such a publication would elicit honorable and fair discussion of the questions involved, and failing to sustain my positions I could retire from the prosecution of the work in good order. If, on the other hand, no valid reason could be given why I should retreat from my position I might take an advance step, and after proper correc-

tion, revision, and enlargement, I would be justified in then consolidating my work and giving it to the world in book form.

This course I have pursued, with the following results:

When my publications appeared I received from all parts of the United States letters manifestly written by men who understood themselves, wherein they affirmed their entire satisfaction with the positions taken and doctrines advocated, acknowledging themselves under great obligations for the information communicated, many of them urging me to continue my investigation and favor the public with the results. A few even went so far as to ask me for my photograph to grace a gallery of original thinkers. All of which was truly gratifying.

On the other hand the editor of the *Microcosm*, A. Wilford Hall, Ph. D., called attention to my articles in the following manner:

"We hope that our scientific readers will carefully consider and even study Dr. Kavanaugh's series of very able articles now appearing in this journal on 'Electricity as the Motor Power of the Solar System.' If he is

right it totally overthrows the Newtonian system of astronomy, as well as the law of gravity upon which it is based. We are not now prepared to indorse Dr. Kavanaugh's position; and though we believe that Newton's law is badly defective in many respects, we still see no way of avoiding the general conclusion that gravity and projection combined do the work of keeping the moon and the planets in their orbits. Yet we have no prejudice at all against any view, and are willing and even anxious to be convinced of the truth of the electric system as the doctor maintains it—that is, if it be true. It is plausible in many of the phases of its presentation; but the cardinal question involved is whether *magnetic attraction*, however powerful the magnets, will act at such enormous distances in view of the well-known rapid decrease of effect witnessed in the most powerful magnets known. At this point we confess that our doubts are unmanageable. But we propose to hear the doctor out before deciding. In reference to the theory of the tides, as taught in the books, we have never been satisfied, and think that the whole thing can be abundantly explained by

the action of gravity alone, with one or two things left out of the old theories and one or two new ideas incorporated. Next month, or as soon as we have time, we purpose giving the new theory of our own, and hope to make the matter plain to the comprehension even of the unscientific reader."

Here Dr. Hall, though committing himself to the doctrine of universal gravitation, admits its partial failure to account for the ebbs and flows of the tides, in which particular he proposes to amend it at some future time, which promise has not yet been fulfilled, in our knowledge.

In regard to his other doubts and difficulties expressed in the extract, an answer was delayed for some months because, when a new question is presented not heretofore brought under consideration, I prefer by patient reflection and investigation to satisfy myself whether the position I am to take is true and in strict harmony with the whole theory of solar-electric action.

Before attempting to solve the doubts expressed, we premise a few general remarks.

It must be borne in mind that the theory

which I advocate is original and new, so far as my reading extends, and hence I have no authors to consult, and only obtain my knowledge of the subjects involved from close study of the works of God as seen in the material universe. I have, of course, to interpret the designs of the Divine Author in the regulation and control of the various members of the solar system by such active agencies and forces as are known to exist commensurate with the regions they occupy. In pursuing this line of study I am compelled to travel over unexplored ground, with no footprints of predecessors to guide me, relying wholly upon close observation and the compass of reason and sound logic, under the lights manifested by the great solar center of the system with such reflected rays as are thrown out by every member of the planetary family.

The doubts and difficulties suggested by the editor of the *Microcosm* are such as I aimed to draw out, and are not only very acceptable and kind, but it will be found they led to the elucidation of an important feature of the theory, and one essential to its completeness. To reduce the objection to a dis-

tinct question, we state it as follows: Does positive electricity waste or exhaust itself in passing from the sun to the earth?

In considering this question the editor, in supposing that it does, doubtless arrived at that conclusion from observations made upan electric machines, and attempts to conduct the generated electricity along lines parallel with the surface of the earth. Whenever this is attempted there will be great waste, and the line upon which it is conducted will extend to a comparatively short distance before it will be totally lost. The reasons for this are manifest. The line of positive electricity conducted, say upon a wire near to and horizontal with the earth, will be on all sides surrounded by negative electricity, which has a great affinity for it, and hence the line of positive will soon be taken up and neutralized. If his conclusions have been drawn from lines so situated and acting, then his doubts are well taken and certainly correct.

But if he applies this reasoning to rays of heat, light, and electricity emanating from the sun, and supposes that they should be wasted or weakened in their passage to the earth or

to the other planets, then upon an investigation of the subject he will find his doubts are groundless. This will appear from the following considerations:

1. The sun is the only fountain-source of positive electricity in the solar system, united as it is with light and latent heat. The distance of the sun from the earth is variously estimated from ninety-two to ninety-five millions of miles. A ray of light is supposed to pass this distance in a fraction less than eight minutes. Each ray, being positive, repels every other ray, and hence, so far from being attracted by any thing above or around it, every surrounding force compels it to retain its own elements within itself, while the repelling force of the sun behind and the attractive force of the earth in front, bear it rapidly to its destination until it reaches the lower atmosphere, where negative electricity prevails. The time is inconceivably short in which it passes this thin stratum immediately surrounding the earth, and hence there is no dissipation of its force until it strikes the earth's surface. Experiments have shown that the sun's rays may be passed through a lens

of ice without a dissolution of their parts, until, brought to a focus upon combustible matter, the light, being converted into heat, will produce combustion as readily as if passed through a lens of glass. In view of this fact, we may safely conclude that the elements of each ray, as it passes through the intermediate space between the sun and earth, undergo no change, and it emits nothing but light in its whole course. It is known that the intermediate space is intensely cold, and heat is evolved only when the ray strikes an opaque body, when the light is instantly resolved into heat, The atmosphere is not warmed by the direct passage of the sun's rays, but by the reflected rays from the earth's surface.

2. But the editor's objections may be considered in another light, which is probably the correct one; that is, he speaks of very "powerful *magnets*," as if he alluded to magnetic iron or a fixed magnetism in any solid body. If this is the light in which he places his objection, then the subject must be considered from that point of view, and it becomes necessary to arrive at a distinct understanding as to the magnet he alludes to.

Of necessity, we must define and understand the terms we use. Properly speaking, magnetism or electro-magnetism is a secondary form of electric action, and pertains only to the earth, and is not identical with electricity proper, or positive electricity, which, in our system of worlds, has its source alone in the sun. The term magnetism, therefore, must be confined to the terrestrial sphere.

It may be truly said that the whole earth is a magnet. If the proof of this is demanded, we reply that it is polarized, and polarization occurs only in magnetized bodies. As this can not be denied, the editor's objection must be confined to terrestrial limits, and, if so, we agree that in the exhibition of its forces magnetism is confined to a very narrow limit compared to the forces of the sun.

Now, in applying these objections to the theory that I am endeavoring to set forth, let us preserve a clear and distinct discrimination as to the meaning of the terms we employ. My whole theory is based upon this declaration, "Electricity is the Motor Power of the Solar System," and electro-magnetism is only incidental to the great power relied on. It is

true that electro-magnetism has an office to perform under the controlling action of the sun operating upon it through the superior force of positive electricity. To apply these forces in their action one upon the other in producing the diurnal and annual revolutions of the earth, we refer our readers to the use made of the one and the other in all the preceding articles of this series, in which it will be perceived that in no case do we assign any motor power to the magnetism of the earth, except so far as to make it a counterpart to the positive electricity of the sun.

To explain more fully: As the earth is a great globular mass, heavily charged with electro-magnetism—a body to be moved, and *not* the mover—by taking on the form of negative electricity, opposite to that of the sun, for which it has a powerful affinity, it is found to possess just those elements which both attract the positive and enable the positive to seize upon it as a leverage, a great bond of power by which to wield it in its course and give it rotation upon its axis.

To be a little more explicit: When the earth, revolving upon its axis, has turned away

its heated surface from the falling rays of the sun, while passing through the shades of night it loses its heavy charge of positive electricity and becomes negatively electric; as it again emerges from the darkness the strong affinity between the negative and positive causes a strong attraction between the earth and sun on that side. The short arm of the negative grasps hands with the long arm of the positive electricity, and they mutually pull together and raise the rising side of the earth until it reaches the zenith, when the surface becomes so heavily charged that it is repelled from the sun, which gives the earth its diurnal motion.

The annual motion is produced by the accumulation of so heavy a charge of positive electricity on the eastern or receding side that it acts as an enormous battery driving the whole globe in the opposite direction in the pathway of its orbit. This action is greatly aided by the fact that the western side is in a negative electric state, and, as regards positive electricity, furnishes a vacuum into which the earth plunges, where it finds no resistance, and hence an easy escape from the driving force behind—viz., the repulsion of positives—and

is thus forced forward in its orbit. This example serves to illustrate the relative outgoing forces of the magnetic earth on the one hand with its short arm, and on the other the vast force of the positive sun, with its long arm reaching through space without exhausting its powers.

More fully to sustain this position, we may with propriety say that the sun expends itself by sending off the substance of its own compound light, heat, and electricity throughout its realm, without the diminution of its force.

In our article on the character of the sun it is shown that the light, heat, and electricity emanating from its shining surface are substantial matter, so much so that it must in the nature of things exhaust itself and expire, unless furnished with supplies to balance its expenditures. The rays of light that fall upon the earth are a part of the sun itself, only in an attenuated form, so that we may say that every planet "lives and moves and has its being" in the borders of the sun.

It will be remembered that it was also shown that the exhausted rays of positive

electricity, passing from the dynamic to the static condition, were drawn back to the sun, where they entered into its body through open caverns known as "spots on the sun," where, being quickened into the dynamic state, they are again repelled into outer space to perform their legitimate offices in whatever region they are directed.

We thus, as far as we understood the designs of the editor, vindicated our theory from the objections so respectfully made. The terms "magnetism" and "electricity" proper are too often indiscriminately used, the one for the other.

In the April (1883) number of the *Microcosm* the esteemed editor favored us again with a few remarks in regard to my articles which, though in the main complimentary, yet show he has somewhat against us. As far as we could, in the biref space allotted us in the *Microcosm*, we noticed the objections in detail as they stand related to the great cardinal points of the theory, as follows:

The subject of electricity as the great motor of the solar system is so vast in its magnitude and proportions that it requires many years of patient thought and investigation to com-

prehend its nature and the manifold forms of its action. It would be unreasonable to suppose that any mind, however gifted and enlightened, should comprehend at a glance the profound mysteries made plain by a proper study and development of its character.

The philosophic world labored for centuries to ascertain, if possible, by what great agent the systems of our universe are regulated and controlled in their combined and co-ordinate actions and revolutions.

The FACTS of astronomy, as developed by Copernicus, Kepler, Galileo, Newton, and others, as set forth in the present system, are justly regarded as "established." In respect to these there is no controversy.

But when we go behind these phenomena, and inquire for the *cause* which gives to all parts of the solar system their motions, which cause, from their harmonious regularity, must be regarded as a unit or one great physical force, the main question to be determined is: What constitutes this one all-pervading force?

Sir Isaac Newton leads off with the answer that it is universal gravitation. This idea was suggested by the falling apple; and seizing

upon the terrestrial force which holds the earth intact, and binds to it all material substances thereunto appertaining, by analogy he extended its application to the starry spheres, and upon a purely *speculative* philosophy he has attempted to enthrone universal gravitation as the ruling force of the universe.

Into this mistake Sir Isaac Newton and his compeers were led by the fact that gravity was the greatest power *then known* in nature. The Newtonian system was built upon this idea, and the learned world have accepted it in its entirety notwithstanding many parts of it are inharmonious with other parts, quoting the names of its great authors as absolute authority for all the positions assumed, and no further investigations were made into nature for further revelations.

Sir Isaac Newton died in March, 1727, twenty-five years before the discovery by Dr. Franklin of the universal prevalence of electricity, and yet up to the present day the Newtonian theory has not been modified to adjust it to this new and important discovery.

We live in a more progressive age, where great names and hoary doctrines should lose

sway over the public mind, when the theories promulged by them are contradicted by clearly defined facts in nature; and the true scientist should bow with homage and respect to the authority of TRUTH only, irrespective of the prestige of names or the prejudices of education.

The electric theory, whose rightful claim to the approval and acceptance of all honest and independent thinkers, I have humbly sought to set forth and vindicate in a brief outline view, assumes that gravitation is *not a universal* force, and hence that some other agent must be found to perform the functions hitherto ascribed to it as such.

There are found in nature three imponderable elements—light, heat, and electricity—over which gravitation has no influence whatever. These three elements proceed from the sun, and are combined as a kind of trinity in unity in every solar ray, and act conjointly or separately, as circumstances and exigencies demand.

One of these elements, when considered in the endless diversity of its action, is found possessed of energies every way adequate to

accomplish the great design of giving and sustaining motion in every member, whether solid or nebulous, of the solar system.

This element, positive electricity, is above and independent of gravitation, is infinite in the area of its action, its functions vastly diversified; hence we hold it is rightfully enthroned and crowned as God's great motor-monarch to control the movements and mutual relations of all parts of the material universe.

Having sufficiently set forth some of the great cardinal features of my theory, I will now briefly revert to the objections made by Dr. Hall in the article under consideration, and endeavor to answer them in detail. In doing so space will not permit me to copy them all in full, but I request the reader to refer to the article itself in the April *Microcosm*, 1883.

Dr. Hall says: "So far as we are aware, electricity proper, whether positive or negative, does not pull or push any object in the slightest degree by passing from one object to another. We believe, in fact, that all the electricity that can be forced through a wire would not pull or push the weight of a feather between two objects thus connected."

In reply, I state that there is a "push and pull" power, and in some instances a very destructive one, in the passage of currents of electricity from the sun to the earth. For example, (1) The accumulation of electricity in the clouds in its passage to the earth in the form of lightning is a most fearful thing when it strikes a tall tree and shivers it to splinters. To protect houses from this terrific "push and pull," thousands of dollars are annually expended in lightning-rods. (2) When a low barometer, acting wholly by electric force, gathers up from ocean or lake vast volumes of water, carries it in defiance of gravitation into the upper atmosphere, and vaporizes it into clouds, there is a very considerable amount of "pushing and pulling" in the process. In either of these cases if the doctor's "feather" was in the way we think we could move it.

We would remind the doctor that in conducting electro-magnetism "through a wire" between two bodies the magnetic current has a stronger affinity for the wire than for surrounding objects, and hence they are not affected by its passage, for magnetism passes *through* the body of the wire.

Not so with positive electricity, which acts on the surface only of solid bodies, and is continually flying off when surrounded by negative electricity. To demonstrate this, if you lay a feather or any light substance on the prime conductor of an electric machine, and throw on a charge of positive electricity, it will be pushed from its position.

The doctor alludes to the action of the magnetic needle, and says "it was formerly supposed that it turned north and south because immense quantities of loadstone were located at the poles of the earth." Yes, even so; and this doctrine prevailed up to the time of the introduction of the electric theory, and the subject would have remained obscure but for the light thereby thrown upon it; for there it nothing in the Newtonian system to relieve it.

The doctor very well knows that if you approach the positive end of the needle with the positive point of a magnetic bar it will be instantly repelled; and if you reverse the end of the magnet, presenting the negative to the positive, it will be attracted with the same force. These well-known facts may serve a

valuable purpose. Let this illustrate the action of the sun upon the poles of the earth. When the earth reaches its winter solstice, December 22d, it presents its negative pole to the positive sun, and there is a mutual attraction between them, resulting from opposite electric conditions, which brings the earth to its perihelion or nearest point. From this time the South Pole turns gradually away until after the vernal equinox it sinks into shadow, and the North Pole gradually emerges into the light; and as it is in like electric condition with the sun, the earth continues to recede until the 22d of June, when it reaches its aphelion, which is five or six millions of miles more distant than at the opposite point of its orbit.

Further, to show that the magnetic force of the earth centers in the poles, we illustrate by the following example: Take a magnetized steel bar eight feet in length to represent the eight thousand miles of the earth's polar diameter, rest it upon a central stand, and suspend across it at regular intervals seventeen pairs of pith-balls attached by threads a foot in length, when it will be seen that the balls nearer the

polar ends will greatly repel each other, and the force of repulsion diminishes from either end to the central pair, where it is imperceptible. This is the test of a delicate electrometer, and clearly shows why the earth, midway between the poles, does not "attract iron any more than wood or brass."

From this experiment is clearly deduced this fact, that all the direct magnetic force of the earth manifests and centers in the poles. These form, so to speak, hooks or handles by which the positive electricity of the sun can lay hold of these magnetic centers and wield the globe in its course both upon its axis and in its annual revolution. Our theory by no means ignores magnetic attraction.

To further illustrate and demonstrate the "pushing and pulling" powers of positive and negative electricity by currents passing through the atmosphere to the earth, we give the ebbs and flows of the tides under the electric action of the moon as a case in point. According to our theory, when the moon presents its dark or negative side to the earth, as at new moon, it "pulls" the waters of the ocean which are in a positive state, and "pushes" those that are

in a negative condition to the opposite side of the earth, producing thereby antipodal tides. In this case there is a revolving polarity established in the waters.

I close these examples by insisting that the eccentric flight of comets in their very elongated orbits is due to the pushing and pulling power of positive electricity proceeding directly from the sun. The comet, which is a nebulous body (not solid, as claimed by gravitationists), as it approaches the sun in a negative condition, passes rapidly close around it for three-fifths of a circle, where it is powerfully charged throughout with positive electricity; and, as positive repels positive, it is repelled by the sun to far distant space, whence it sometimes requires three hundred years to make its return. In accomplishing its extraordinary flight it sets at defiance and tramples under foot every law prescribed for its action by the gravitation theory, and strictly conforms to the known laws of electricity.

In regard to the casual remark in a former chapter that "the attraction of gravitation may reach the moon," I spoke in doubtful terms; for my mind is not clearly made up on

that subject. As the earth and moon are both negative bodies there is no great gravitating force between them; the difficulty seems to be to find an adequate propelling force to carry the moon forward in its orbit. As but little attention has been given to this subject heretofore, I reserve my opinion as to the laws that apply to it until more light and demonstrated facts can be brought to bear upon it.

In every part of my theory I repudiate the idea that the momentum given at their creation to revolving bodies was adequate to keep them in perpetual motion, annual and diurnal, through all time. Such an idea is unnatural, and can not be sustained when we consider that their pathway is surrounded and overshadowed by forces which, if unfriendly to their actions, are competent to retard or stop them, or, if friendly, to promote and continue them. In these forces we find an adequate propelling power for each, and we are left to inquire, how do these affect the moon?

In closing these remarks, already protracted beyond my intention, I return to the editor profound thanks for the occasion afforded me to bring out before the readers of the *Micro-*

*cosm* some important features of my theory, not hitherto fully portrayed. I allude to the beautiful harmony presented throughout the electric theory, wherein are seen the workings of a twofold, self-adjusting balance of power, which, at Dr. Hall's suggestion, I name "Push and Pull." Thanks for the suggestion. This pair of powers work beautifully together in all parts of the stupendous machinery of the universe. Like two celestial steeds, they career in the heavens, and carry forward with admirable skill and dexterity the various evolutions known to the sublime science of astronomy.

I derive peculiar gratification from witnessing the ease and elegance of their movements in overcoming every difficulty that has stood in the way of progress in former times, when our fathers in this science had harnessed up and trained an inferior steed, which upon a trial of his powers proved to be blind, halt, and spavined, and wholly incapable of performing the dexterous feats so essential to success in his distinguished calling. The truth is that a "one-horse" power, all "pull" and no "push," was a sad over-

sight in looking into the mechanism of the spheres.

We come to the relief of the clumsy, overburdened old steed of "universal gravitation," and propose to release him from duty in the upper spheres, and for the future give him repose in the home pasture taking care of terrestrial interests, while the fiery coursers of electricity, *pull* and *push*, shall maintain their rightful position in the wide domain of universal nature.

We give the above quoted objections as specimens of the trivial and flimsy character of the few exceptions taken to my views as presented in the *Microcosm*. Doubtless Dr. Hall is excusable for not taking a more comprehensive view of the electric theory, for the reason that we find in his able work, "The Problem of Human Life Here and Hereafter," that he, like Samson, has been busily slaying a host of "evolution" Philistines. In this work he encounters the wave theory of sound, which he has been trying for years to demolish, and he has been too busy to analyze the vast subject involved in the electric theory of astronomy.

We have already offered him a "life-boat," that when he finds that the old ship of universal gravitation, which he admits is leaky, is about to sink 'neath the waves of oblivion, he may take passage in the celestial chariot of universal electricity, so gallantly drawn by the immortal steeds, "Push and Pull." As these have never failed in the centuries past, there is no risk in identifying our fortunes with their future success.

This offer is still open to our friend Dr. Hall.

## Chapter XIV.

*THE DOCTRINE OF UNIVERSAL GRAVITATION CONSIDERED, WITH OBJECTIONS.*

MY series of articles entitled "Electricity the Motor Power of the Solar System," published in the second volume of Wilford's *Microcosm*, closed with the July number, 1883.

After that series was complete Dr. Hall courteously invited me to continue my contributions to the *Microcosm* as a regular correspondent. I accepted his invitation on the condition that the subject of a new series should be "The Doctrine of Universal Gravitation Considered, with Objections." To this he positively objected, stating that it would open a wide field for discussion, in which he would have to take a part, and several of his regular contributors would also claim the right of defending the old Newtonian doctrine.

The discussion of this subject is the very point I desired, for Dr. Hall had stated him-

self that if my doctrines set forth in "The Electric Theory of Astronomy" were correct, they would overthrow the Newtonian theory entirely. In this I concurred with him, and hence my desire to test the validity of my doctrines by a fair and full discussion of the subject through the public press. As my whole theory had been presented through the *Microcosm*, I desired that the readers of that magazine might have the benefit of the controversy in close connection with my presentation of the electric theory.

As Dr. Hall, in the exercise of his editorial prerogative, chose to exclude the discussion from his columns, and the success and validity of my electric theory chiefly depends upon the proving that the doctrines of universal gravitation are false, and should be so regarded by every scientist, I am laid under the necessity of taking up the subject and considering it in this work.

In undertaking this task I am fully impressed with the fact that I come into immediate conflict with the prejudices of education, the teachings of all the schools, and the potency and prestige of the ablest writers on the

subject for the last two centuries. To overturn and revolutionize public sentiment on a subject so indispensable to the old system of astronomy, in the minds of many, is a thing impossible. But as great revolutions have occurred in regard to the foundation principles of astronomic science in the past, and as the universal gravitation theory was established in the absence of subsequent discoveries wholly unknown to the founders of that doctrine, and as we live in an enlightened age, where reason and the force of truth have gained a greater dominion over the public mind than in former times, encouraged by these considerations, fairly and dispassionately, I propose to bring the reasons on which my theory is founded, and my objections to the gravitation theory before the world, well satisfied that they will be duly considered by a great majority of intelligent readers, and ultimately, when the whole ground is surveyed, and the vast subject properly understood, the theory of electric attraction and repulsion will be found to answer all the demands in nature, in regulating and controlling the action of celestial bodies, so completely that there will

be no more reason found longer to contend for the fabulous doctrine of universal gravitation.

In setting forth the various parts of my electric theory I have incidentally come into contact with the commonly received idea of universal gravitation, and have given the subject a very brief consideration, with objections, as they occur, but it was my constant aim to exclude full consideration of these objections from the body of the work till all parts of my electric theory had been fully set forth. Hence this addition to the work is indispensable.

Universal gravitation is defined by Professor Olmsted, for many years the professor of astronomy in Yale College, to be "that influence by which every body in the universe, whether great or small, tends towards every other with a force which is directly as the quantity of matter, and inversely as the square of the distance."

This definition is enlarged and refined upon by later writers to read about as follows: "Universal gravitation is that influence by which every body and every particle of that body tends towards every other body, and

every particle in every other body, with a force," etc.

Laying this down as the basis of the action of a universal force intended to regulate and control all moving bodies in the universe, the first difficulty which suggests itself to the reflecting mind is this: that if lines of attraction are drawn from one of these bodies, and from every particle of matter within one of these bodies, to every other body in the universe, and every particle of matter in every other body, and this first body from which the process starts is surrounded on all sides with like bodies, each acting in accordance with the law of distance and quantity of matter, it would be a perplexing question to any mind, learned or unlearned, to determine the direction of the preponderating force, or to analyze and define the order of action in bringing to pass the motions which each body is known to take.

A second difficulty arises. As the whole process is based upon the atomic system, which is strongly insisted upon, what force can an atom of matter belonging to the earth possibly exert upon the most remote bodies known to exist in the universe, countless mill-

ions of miles away from our solar system? Is there any evidence offered by the advocates of the doctrine of universal gravitation to sustain this feature in their system?

A third difficulty may be named, more general in its character, and that is that the system is devoid of proof that the planets, in their whole bodies or in their atomic character, gravitate to each other at all.

It is known that there is an electric force pervading the universe proceeding from great solar centers, which imparts a magnetic or electric condition to all primary and secondary planets, and that where they are in the same electric condition they repel each other, and when in opposite electric conditions they attract each other, as may be demonstrated by the well-known experiment with the pith-balls upon the electric machine. But to assume that the attraction of one planet interferes with the motion or action of any other planet, on the principle of universal gravitation is wholly an assumption devoid of truth.

I have stated in the preceding pages that terrestrial gravitation, in regard to the earth and other planets, is known to exist, but in

the nature of things is limited within a prescribed sphere. Gravitation in a planet is essential to its unity, giving permanency to its parts and regulating its hydraulic system.

Difficulties of this character might be multiplied indefinitely, all based upon reasonable grounds, which tend to place the gravitation theory in an absurd and ridiculous light, and yet they are all fairly drawn from premises laid down in the definition given.

I will now briefly allude to the points wherein the electric theory differs from the Newtonian or gravitation theory, as noticed above.

1. Gravitationists contend that the only force by which every celestial body is kept in perpetual motion is that of the *momentum* given it by the Creator when it was launched into being; and to sustain this position they have to assume that the space through which the bodies revolve is a perfect vacuum, otherwise the motion would be retarded.

Electricians contend that both these propositions are false; that in Nature there are no vacuums, and if not, then there must be forces in space, which, if unfriendly to motion, have

the power to retard, or if favorable to perpetuate their motions, both diurnal and annual. This agency, we contend, is found in the attractive and repulsive forces of electricity, as shown in Chapters I and II.

2. The gravitation theory presents no satisfactory causes for the elliptic form of the earth's orbit, or the inclination of its axis to the plane of its orbit.

The electric theory proves that both the elliptic form of the earth's orbit and the inclination of its plane are electric necessities, as explained in Chapter III.

3. It is contended by gravitationists that the earth, in its revolutions around the sun, is kept upon a balance between the centrifugal and centripetal forces; that should the earth vary from its course in its orbit, and approach nearer to the sun than its prescribed path, the centripetal would gain the mastery, and carry the earth into the bosom of the sun, where it would be consumed; or if the centrifugal force should prevail, and carry the earth beyond the limit of its orbital path, the balance would be broken, and the globe would run riot through space and be lost.

The electric theory holds that the earth, under the attracting and repelling influences of the sun, is held upon an electric balance in its orbit, and to fall within or depart from its assigned path is an electric or natural impossibility, for, should it approach nearer the sun, positive electricity would so accumulate upon it as to repel it to its proper balance; and should it depart beyond the limits of its orbit, it would immediately pass to a negative condition, and be attracted back to its proper position.

To prove that this position is correct, it is only necessary to call attention to the action of comets in their very elongated elliptic orbits. It must be remembered that gravitationists know of no law but that of gravitation, by which all the heavenly bodies, including comets, are controlled in their action, and hence gravitation must apply to these.

Now, it is well known that the larger comets, in their return to the sun, drive with great force and pass immediately around the sun, and thence continue their rapid flight away from the sun, until in their course they

pass to parts so remote as to reach beyond the outer limits of all the planets belonging to our solar system. In this case what becomes of the centripetal and centrifugal forces? In their near approaches to, and distant departures from, the sun they have certainly passed both danger points, and have not been consumed on the one hand nor lost in distant space on the other.

We desire no better witness than that of all the comets to prove, in the first place, that the centripetal and centrifugal forces of gravitationists are wholly unknown in Nature as applied to heavenly bodies; and, in the second place, the electric theory becomes self-evident when applied to the flight of comets, as we shall see.

In the first place, comets are not solid, but nebulous bodies, and (2) being nebulous, they can be charged from center to circumference with positive electricity, and (3) when at their most remote point from the sun they lose their positively electric character, and become negative; and (4) being decidedly negative, they are attracted with great force by the positive sun; and (5) in passing immediately three-

fifths around the sun they are recharged from center to circumference with positive electricity; and (6), as positive repels positive, they are repelled with great force to the most distant point, or until the positive condition is exhausted, when they return as before.

It is worthy of remark here that the tail of the comet in departing from the sun is always driven from the sun; and if the sun, according to gravitationists, has only an attracting force, then, if the illuminated gases which form the tail of the comet are repelled, there is a repulsive power in the sun which is unknown to gravitationists.

Before passing from the subject of planets being thrown from their course, as taught by the old theory, I deem it proper here to state that according to the doctrines and principles of the electric theory it is utterly impossible for any planetary body so far to vary from its legitimate path as to come in conflict with any other body; for as all are charged with electric force the negatives mutually repel each other, and all the planets with their secondaries being negative, collision is impossible.

The fourth point in which our theory dif-

fers from that taught in the schools is in regard to the ebbs and flows of the tides. The old-school doctrine is that high or spring tide is produced, as at new moon, by the sun and moon being on the same side of the earth and by their uniting their attractive forces.

This would seem plausible enough if there was but one tide; but as there are two of equal height, and each rising at the same moment on opposite sides of the globe, the question naturally arises, What forces are employed in producing the antipodal or opposite tide, where there is neither sun nor moon to attract?

Dr. Hall frankly confesses that the Newtonian theory is sadly at fault at this point, and he has promised us an amendment to the law, but up to this time he has failed to produce it.

Some who teach the old system have resorted to several subterfuges to account for the antipodal tide, but they are so unsatisfactory, not to say silly, that the more sensible prefer to be silent on that subject.

The most common answer to the question is that, as the sun and moon exert so violent a power on the side of the earth next them,

the whole earth is jerked away from the waters on the opposite side, and the twin tide is thus produced.

In public lectures before learned men we have called in vain for a solution of this mysterious phenomenon, and it is confessed that the gravitation theory gives no satisfactory explanation.

Under the electric theory this whole subject becomes clear and plain.

It is now generally conceded that the ebbs and flows of the tide are due to the action of the moon. Now, if this action were by its gravitating force the tides would be equal in every part around the whole earth, and, as it is well known that this is not the fact, then the action can not be by gravitation. If not, then it must be by electric force, and we find this to be the case for the following reasons:

At new moon the dark or negative side of the moon is presented to the earth, and as negative attracts positive and repels negative, and the waters of the earth are always highly charged with electricity, it is found that the waters in a positively electrified state are strongly attracted towards the moon, and the

waters of the ocean which are in a negative electric state are repelled to the opposite side of the earth, thus producing a polarity in the waters, the positive pole being under the moon at this period and the negative at the opposite side of the earth.

At full moon we again have high tide. In this case the positive or illuminated side of the moon is presented to the earth, and the waters in a negative condition are attracted and those in a positive state are repelled, and thus the polarities are reversed.

At the first and third quarters of the moon, when one-half of the moon's disc is in an illuminated or positive state and one-half in a dark or negative condition, then we have neap or low tide, and it will be found that the tides will vary just as opposite electric surface is presented by the moon to the earth.

There is another electric phenomenon produced by the action of electricity on the waters of the ocean, for which gravitationists can not satisfactorily account, for the reason, doubtless, that there is no law or principle known to their system by which it can be accounted for. I allude to the interchange of ocean currents

between the poles. It has been shown in a former part of this work that the whole earth is a magnet, and consequently is polarized, and that the full force of the magnetic power of the earth is manifested at its poles. It is generally conceded that three-fourths of the earth's surface, including both the boreal and austral poles, are submerged in water, which is a good conductor of electricity. The waters, therefore, of the ocean, flowing to the North Pole, from a south-easterly direction, are heavily charged with positive electricity or magnetism, and hence the waters and the pole being in the same magnetic condition, the waters are repelled in a south-westerly direction, where they wind around the earth in a spiral course, as far as the channels of the ocean will permit, passing through the tropics driven by the positive force behind and attracted by the negative pole, they are drawn to the austral pole, where they lose their positive electricity, and are highly charged with negative, and thence are in turn repelled northward, the two channels passing on opposite sides of the earth.

By this wonderful provision in nature there

are incalculable benefits bestowed on all parts of the earth. The icebergs of the frozen north are borne along by these currents in the direction of the tropics, where they exert a powerful influence in lowering the temperature, also in carrying the waters of the tropics to the polar regions, and thereby exercising a modifying influence on the temperature of the North.

But the great argument on which the gravitation theory rests for its support, is that the sun, being seven hundred and fifty times greater than all the planets combined, forms the great central orb from which proceeds a gravitating force centering upon itself sufficient to control all subordinate members of the solar family.

Now, if it turns out under investigation, as it certainly will, that the sun is a great *electric* body, amply endowed with an all-pervading electric energy sufficient to accomplish all the work assigned it in our theory, then we may readily and safely conclude that there really belongs to the sun not a particle of that gravitating force claimed for it by the advocates of the Newtonian theory; and thus the key-

stone of the great arch built by gravitationists being removed, there will be left no vestige of the central force on which the doctrine of universal gravitation depends. Then assuredly the whole false fabric will be seen to tumble into a heap of ruins, while the principles of electric attraction and repulsion will gloriously triumph.

So well satisfied am I of this conclusion that I am willing that the success or failure of the truth of my theory should be tried by this test alone. If I do not demonstrate the fact that the sun is an electric center, I shall come so near to it that every enlightened and unprejudiced mind will concede the fact when the following argument is well considered.

My theory assumes that the whole earth is one great magnet. A magnet of such magnitude, in the nature of things, must derive the elements that constitute it such from a superior source differing as widely in magnitude as the sun is superior to the earth.

If the earth is a magnet, it requires an electric central force equal to that of the sun to produce it. The question then resolves itself into this, Is the whole earth a magnet? That

it is such in all its parts is demonstrated by the fact that it is very heavily polarized, and no mass of matter can be polarized without being magnetized. Now, if the question arises, Where is the electric source of its magnetism? there can be but one answer, and that is, In the sun.

That the magnetic earth calls for and requires on the part of its solar ruler the exercise of forces and powers which form the counterpart of its own endowments, is but a natural and philosophical conclusion. The earth's nature and condition necessitate the presence and power of just such a sun as the electric theory presents, and the sun on its part, for the purposes of harmonious government, demands and necessitates just such magnetism and polarization as we find the earth possessed of, and as our theory ascribes to it. From the demands and conclusions here set forth I see no escape.

With the light of these facts before us—with the cumbrous and beclouded idea of universal gravitation removed—when we return to the consideration of the true character and functions of the sun, as set forth in the pres-

ent system of electric astronomy, there will be seen a most symmetrical harmony and beauty to prevail in all its parts. So perfect and complete are its provisions that the demands of the whole earth upon the sun to supply the elements and agencies by which its functions and life force are sustained are fully answered and supplied. But far beyond this demand, all parts of animated nature, from the greatest to the least, descending even into animalcular life and all parts of the vegetable kingdom, are contemplated and provided for in a way nowhere else so satisfactorily shown as by the electric theory.

In conclusion, then, we may safely assume that the sun is a great electric body, and that the earth is a great magnet, which is demonstrated by its polarity. These two great facts are established beyond question, as conceded by Professor Joseph Henry, of the Smithsonian Institute; by Professor Tice, the author of "A New System of Electric Meteorology," and by Professor George Brewster, of the North-west, a great scientist. Each, without intercourse with the other, arrived at the same conclusion as myself in regard to the electric

character of the sun and earth, as will be seen in another part of this book. Here we rest our cause, for if these two great controlling bodies, in their compounds and constitutions, perfectly harmonize, and all other planets belonging to the solar system by analogy are claimed to be of the same general character as the earth, then beyond all doubt or disputation the electric system of astronomy is sustained in all its parts, for all minor questions in the system must necessarily agree with these, as they are shown to do in the body of this work.

## Chapter XV.

*DOCTRINE OF UNIVERSAL GRAVITATION CONSIDERED, WITH OBJECTIONS—CONTINUED.*

A MORE general and comprehensive ground is taken by the more reflecting gravitationists in support of their system altogether different from that noticed in the preceding chapter—*i. e.*, that of necessity the doctrine of gravitation is absolutely necessary to the perfection of the Copernican system of astronomy, for, say they, there is no other basis on which mathematical calculations could be founded than that of universal gravitation. The stability and firmness of the whole system depends upon that basis. It is upon this ground that we calculate the transits of Venus, the eclipses of the sun and of the moon, and that by the interferences of one planet with another its variations in some portions of its orbit are accounted for, and even the discovery of before unknown planets has been accu-

rately anticipated. Without this basis we should be at a loss in all these particulars.

To the grounds here taken I offer the following reply:

I. Now, if we can successfully show that the sun is purely an electric body, and all the forces proceeding from it partaking of its own nature of necessity must be electric, and that both attraction and repulsion are found to exist among these forces, then two conclusions are inevitable:

First, that the sun, which is held by gravitationists to be the great center of gravitation in the solar system and to yield an influence sufficient to control the action of all planetary bodies, in reality has no gravitation force pertaining to it, and the whole universal gravitation system must fall. This in itself is sufficient to overturn the whole system.

Second, to prove that the sun is purely an electric body, as we have already shown, Dr. Joseph Henry devoted his attention to this subject for years, and after a long course of experiments demonstrated, as will be stated in another chapter, that there can be no doubt that "the sun is a great magnet," and upon

the basis of this fact, when appointed by the government to take charge of the Smithsonian Institute, evidently because he was regarded as master of the science to be promoted by that institution, among the first things he did was to establish the signal service. Added to this he introduced observations on the high and low barometers, as they were found to prevail in all the States and Territories of the country, from the reports of which he was enabled to calculate the changes in the weather, the probability of storms, and thereby greatly to promote the guardian and protective policy over the interests of the country.

As the high and low barometers are known to be the great controlling agencies in giving direction and force to the winds and all other elements concerned in the production of storms, and that high and low barometers are alone produced by electric agency, and that the whole system of telegraphing was carried on by the the same agency, it is clear that the whole system is based upon the idea that the sun is a great electric magnet. Thus, practically, the electric theory is recognized by the Smithsonian Institute.

The positions taken by Professor Henry are the same that we have taken, and though the science is in its infancy the progress made in favor of its claims is rapid, and it will doubtless ultimately prevail.

II. The Copernican system was first published in May, 1543, and continued without alteration to 1685, when Sir Isaac Newton first promulged his theory of universal gravitation.

It is well known that the magnitudes of the various planets, their distances from the sun, and their motions were clearly ascertained and the doctrines of their actions established by Johann Kepler as early as 1609, when his first two laws of motion were discovered, the third following in nine years after. By these historic facts it is known that eclipses of the sun and moon and the transits of the inferior planets were as well understood and as accurately computed as they are at the present time; and yet it was without the knowledge of the laws of universal gravitation, which is now claimed as a necessary basis on which to found such calculations. So that in reality the system of astronomy was more perfect,

less complicated, in the days of Kepler and Galileo than at the present time, and hence it is certain gravitation has added nothing to real, authentic astronomy.

But for the introduction of Newton's doctrine of universal gravitation there would be now no controversy as to the causes or forces by which the planetary orbs are moved. But, as often happens, the introduction of errors neeessitates greater research and investigation, which often leads to new discoveries, whereby great advancement is made in the pathway of true science. This research has given rise to the electric theory.

Not to proceed farther on this line, having seen from the foregoing that the true system of astronomy had been established and was complete before the theory of universal gravitation was introduced, no argument is necessary to show that its introduction has rendered no service to true science, and therefore it is superfluous and valueless. The only office it has ever performed has been that of a *hypothetical course* for phenomena that were well ascertained, and natural laws that had been discovered and proclaimed to the world many

years before the theory of universal gravitation was promulgated.

Now that it is seen that this modern and greatly lauded idea of universal gravitation has been weighed in the balances and found wanting in every essential particular as an agent in regulating motion in the solar system, and is therefore repudiated, still the question recurs, What provision has been made in nature for giving uniform and unvarying motion to the great machinery of revolving orbs and burning suns known to exist in the realms of space?

On this important question, of necessity, we are driven to the conclusion that the electric system of astronomy and that alone will be found to meet all the demands.

God in his infinite wisdom and goodness has provided three great imponderable agents which, as a trinity in unity, pervading all space, are endowed with energy and power self-regulating and self-supporting, vicegerents of Omnipotence to execute his sovereign will in carrying forward his great designs and purposes in the material universe. This sublime system is embodied and set forth in the

electric system of astronomy here presented by an humble member of the brotherhood of man, relying upon the truth upon which it is predicated as its vindication.

## Chapter XVI.

*CORROBORATIVE TESTIMONY OF OTHER WRITERS—PROFESSOR JOSEPH HENRY, OF THE SMITHSONIAN INSTITUTE—PROFESSOR GEO. BREWSTER—PROFESSOR JOHN H. TICE; "MOTOR OF NATURE."*

JOSEPH HENRY, LL. D., born in Albany, N. Y., December 17, 1797, where he was educated, and for some time held a position as professor of mathematics in the Albany Academy, became the most eminent electrician that our country has produced. He was the first to demonstrate the principles on which the electro-magnetic telegraph is based. The *American Encyclopedia*, in a sketch of him, says: "He was the first actually to magnetize a piece of iron at a distance, and invented the first machine moved by the agency of electro-magnetism. In March, 1829, he exhibited to the Abany Institute electro-magnets which possessed magnetic power superior to that of any before known, and subsequently

he constructed others on the same plan, one of which, now in the cabinet of the college at Princeton, N. J., will sustain thirty-six hundred pounds with a battery occupying about a cubic foot of space."

The great proficiency made in physical science by Dr. Henry pointed him out as a suitable person to be placed in charge of the Smithsonian Institute, in Washington City, in 1846, where he presided over that institution with great ability until his death, organizing and arranging the system upon which it is conducted.

Since writing the foregoing part of this volume we have found the following passage in the article on "Magneto-electricity," contributed by him to Appleton's *American Cyclopedia*, which recognizes the fundamental principle of our system, both as to the sun and earth.

He says: "The earth being a great magnet, currents of electricity must be induced in all conducting material in which motion takes place at its surface. These currents are, however, of feeble intensity, but their existence may be shown by connecting the ends of a

copper wire, several hundred yards in length, covered with silk and wound around a wooden cylinder of about two feet in length, with a galvanometer, and by suddenly turning the axis of the former from a horizontal position into the direction of the dipping-needle. During the downward motion of the north end of the cylinder the galvanometer will indicate an induced current in an opposite direction to that of the hypothetical current of the earth, and when the motion is reversed, an induced current in the same direction as that of the current in the earth. From this result it must be inferred that electrical currents are constantly produced by the magnetism of the earth, since no change in the direction and position of a conducting body can take place without developing the inductive action. Moreover, since the sun has been proved to be a great magnet, exerting a powerful action on the earth, the daily rotation of the latter must subject it to an inductive action similar to that we have described in the revolving plate of copper. There can be no doubt, in the present state of science, that such currents actually do take place, but their direction and intensity

have not yet been ascertained. But from the association of the magnetic storms we have previously described with the occurrence of the aurora borealis, and also with that of the maximum number of spots on the sun, we are led to the conclusion that the three classes of phenomena are intimately connected, and that they furnish a subject of cosmical research of perhaps as great interest as any which have ever occupied the attention of the scientific world." (Appleton's *Cyclopedia*, Vol. XI, page 18.)

Upon first reading this extract I at once determined to visit Washington City, with the object of interviewing Professor Henry, whom I knew to have occupied the highest position in the scientific department of the Smithsonian Institute, to whom I proposed to submit my whole theory, and obtain his views with regard to it, and to gain such information from him as he was able to impart.

Upon arriving there in April, 1884, I learned for the first time that he was dead, and found only a monument erected by his successors to his memory. I was, however, introduced to Professor Spencer F. Baird, secretary

and director, his able successor in office, to whom I made known in part the object of my visit. Finding that it involved the subject of electricity, he informed me that Professor Taylor was at the head of that department. I was conducted to his office. I was very favorably impressed with Professor Taylor, who had been long in the Institute, and associated with Dr. Henry. I presented him with a volume of my *Microcosm* articles, which he assured me would be carefully read, and I might expect an answer in regard to his estimate of its merits in about a week.

On returning to his office at the appointed time, Professor Taylor informed me that under a rule established by Professor Henry three classes of books were excluded from the publications of the Smithsonian Institute, viz.: those on politics, religion, and such as had not been recognized as established science, and as my electric theory was one of the latter class, he regretted to say it was excluded under this rule.

As Professor Henry, as shown in the extract from his article, declares the sun to be a great electric battery, and the earth also, as a

whole, to be a great magnet, and these are the two essential points upon which my whole theory is based, it is granting all that I ask as a foundation. With these two points admitted, every force and influence derived from the sun must be electric, and as the earth is magnetic, and therefore in harmony with the nature and forces of the sun, the whole government of the sun and earth springs from the inherent active principles of these two orbs, and as all these are incorporated into my theory, I generously bequeath to my gravitation brethren, the forces of the sun and earth not included in these, out of which to build up and sustain, if they can, their tottering superstructure.

Dr. Henry had duly appreciated the far-reaching and all-comprehensive consequences of the electric character of the sun, and the vastness of its dominion over surrounding worlds. He also places the earth in its proper relation to the sun as being a magnet, and speaking of the electric influence exerted by the sun over terrestrial phenomena, he says there is here furnished "a subject of cosmical research of perhaps as great interest as *any*

which have ever occupied the attention of the scientific world." The word "cosmical" is most appropriately used here, being in its widest sense commensurate with the universe, and bears upon its face an almost prophetic grasp of a subject now in its infancy.

PROFESSOR GEORGE BREWSTER. — While my series of articles was in course of publication in the *Microcosm* I received a letter from a gentleman in Philadelphia who had formerly resided in the North-west, desiring to know if I had not met with a work by Professor George Brewster, which had been printed somewhere in the North-west, I forget where, in 1843, but owing to the untimely death of the author had not been bound and put in general circulation. This question was suggested by the doctrines advanced being identical in most respects with my own. I informed the gentlemen that I had never seen or heard of the work referred to; that if he had a copy I should be glad to procure one. He kindly furnished me a copy of a second edition of Professor Brewster's work, republished in 1874 by A. H. STEVENS, M. D., E. D., of Philadelphia, who had rescued the fugitive sheets

of the first edition from oblivion, and appended to them a treatise on "Electricity as a Curative Agent."

This book, entitled "A New Philosophy of Matter," is now before me. It consists of thirteen elaborate and able lectures, chiefly devoted to electricity, light, heat, and gravitation as the imponderable forces in nature. With the exception of the last two, these lectures are purely elementary, and are intended to demonstrate that light, heat, and electricity, emanating from the sun, are one and the same, but acting in different forms, and from these forces are derived the chemical affinities found to exist in all terrestrial substances.

In Lectures XII and XIII the position is taken that the whole earth being a magnet the force known as gravitation is nothing more nor less than the magnetic force of the earth acting upon all terrestrial bodies, and binding them together and giving to the earth, as a whole a complete control over all material substances. He concludes by applying the forces of electricity, which he designates as plus and minus, or positive and negative, in the production of the diurnal and annual rev-

olutions of the earth. In regard to the diurnal motion our views are identical, *i. e.*, that it is produced by the sun's attracting the negative and repelling the positive side of the earth. He says that the annual motion is produced by applying the same principles, but he does not go into the *modus operandi* and show by what process this is effected, as is done in my theory.

Reasoning by analogy, he holds that all planets are moved by the same forces in the same way. He also holds, as I do, that there is an expenditure and a supply of electricity proceeding from and returning by circuit to the sun; that as soon as a ray loses its positive character it is drawn back to the bosom of the sun; but he does not point out, as I do, the provision made for its reception.

He concludes his argument as follows: "We, for instance, have assumed the proposition to be true, and have endeavored to prove it, that electricity is the cause of all attraction and repulsion, upon both a large and small scale, and consequently of all motion among spheres as well as atoms, and that the sun is the fountain whence it originates. . . . And if ob-

jections be urged against such conclusions, those who urge them ought certainly to be prepared to explain the laws by which the sun governs the earth more satisfactorily and plausibly, or else forever hold their peace, and acknowledge their incompetency to do it; for the old stereotyped method of explanation by referring the whole to the influence of the centrifugal and centripetal forces, without explaining *how* those two forces are produced, will not answer—will satisfy no inquiring mind."

Professor Brewster, in one of his lectures, incidentally informs us that his attention was first specially drawn to this subject in 1838. My labors on the same subject commenced in 1834, now more than fifty years ago. I have learned my theory, except the initial point, as credited to Judge Richardson, from no man, and I knew none to apply to. It is a remarkable coincidence that Dr. HENRY, of New York; Professor BREWSTER, of the North-west; Professor TICE, of St. Louis, yet to be more specially noticed, and myself should each be drawn into the same line of thought, make the same discoveries, and arrive at the same conclusions,

drawn from nature alone; and yet there should be such a degree of unity of sentiment, each independent of the other, on a subject of such magnitude!

To these names might be added many more, who, through correspondence and otherwise, have in a general way, without going into particulars, given in their adherence to the theory that electricity is the grand motor power of the universe.

Up to this time, so far as I am informed, I know of no one who has undertaken to reduce these general principles to a system, and undertaken to show the precise process by which electric forces are employed to produce the phenomena set forth in the electric theory presented in this volume.

I have not the vanity to suppose that no errors have been committed, or that in every particular my positions are correct, but I am gratified to know that so far as the subject has been examined by impartial and fair-minded readers, the theory as a whole has met with public approbation to a degree that fully meets my utmost anticipations.

But we have another name to add—Pro-

fessor JOHN H. TICE. With this gentleman I have been intimate for many years. He was for twenty years superintendent of the city schools of St. Louis, and only resigned his lucrative position because he could not conscientiously teach what he believed to be the false doctrine of the system of philosophy adopted by the schools. He is the author of the well-known system of electric meteorology, a science nearly akin to astronomy. He devoted most of his life and labors in perfecting his valuable work on that subject.

In the month of June, 1883, I requested him to give me a general outline view of his theory in regard to the office performed by electricity in regulating and controlling the planetary worlds. His reply, which is here appended, is the last communication I ever received from him, and among the last from his prolific pen. I present it here as a whole, as I wish him to speak for himself. The reader will perceive that his views as to the mode of application of the electric motor differ materially from my own, but we fully agree in the central idea presented in my theory, that electricity *is* the motor power of the

universe. The reader will appreciate the beauty and clearness with which these views are set forth, which have never before appeared in print:

## MOTOR OF NATURE.

BY PROF. JOHN H. TICE.

INTELLECTUAL activity — reasoning and thinking—is restricted to force and matter, because under them is comprehended the entire universe. In our philosophy it must be a fundamental principle that these realities are both indestructible. For a century, or nearly so, the indestructibility of matter has been accepted as a physical axiom, and later the conservation of force, which implies indestructibility, has also been accepted as unquestionable. Accepting the conservation of force as an irrefragable truth, while investigating a physical problem I can not admit any hypothesis or credit any assertion that denies this principle. Every view taken of the problem, while solving it, must be consistent and compatible with the conservation, persistency, and indestructibility of force.

A problem, the motor of the universe, is

presented for solution. The first step is to state truly, fully, and precisely the facts by which the motor manifests itself. When so stated the problem is on the way to solution. A problem such as the one proposed can not be solved without discussing natural energy.

I presume it is conceded that the motor must be one of the natural forces. Hence the investigation has to be confined to an examination and study of the natural forces, in order to determine which of them is the motor, and, when discovered, to verify it by facts and the known laws of that force.

Natural energy manifests itself in four distinct forms, called the natural forces; namely, light, heat, electricity, and constitutism—the latent heat of scholastics—each of which has its separate and distinct function in the economy of Nature. The universe is illuminated by light, warmed by heat, set and kept in motion by electricity, and the condition or state of matter as solid, liquid, and gaseous changed as exigency requires by constitutism. (See my work on "Clouds and their Phenomena," not yet published.)

The operations in the economy of Nature are so manifold and diverse, some simple and others complex, that reason teaches there must be a separate and distinct agent, with special functions to perform each kind of work; for example, as above, one to light up, another to warm, another to move, etc., the universe. At all times every thing is done promptly, and the whole movement goes on harmoniously, because controlled and directed by one mind and one law.

It is true that knowledge, even with the best-informed, of the nature and character of the natural forces is still so defective that no full and clear statement of them can be made, and every attempt to make such is amenable to criticism. In the future, with the progress of knowledge, such statements will be made with less and less obscurity and approximate truth; but until that time arrives, from necessity, only what is known about the forces of nature can be stated.

Some things, however, are so clearly known now that a mistake is not possible to be made about them. It is positively known that the forces of nature are mutually convertible. Hence it is certain that they are identical in

essence and differ only in form. It is also known that when one form of force disappears another appears in its stead, its equivalent in energy. In the whole cycle of changes not an iota of energy is lost or destroyed. It is also known that any form of force in the performance of its function is expended, but not destroyed; for, if what it does is undone, the identical amount of energy expended in some form reappears.

These are the cardinal points to guide us in an investigation, and by them the way can be groped out to light through the most obscure physical problem. Because the way is obscure we ought not to render it totally dark by raising subordinate issues and forcing them into undue prominence. This is an effectual way to lose sight of the main issue, and consequently defeat the object of the discussion.

When there is such a general deficiency of knowledge there should be a modest estimate of our own ability and acquirements, and a timidity in expressing opinions on questions we have not examined, tested, and verified. But with the majority of ill-informed persons the fault is to deal in bold assertions,

as if they could not be or would not be called in question. It would be better to acknowledge that the subject has many aspects that are too deep for them, and that in sounding their plummets did not touch bottom. But no, at the risk of being mortified by exposure and humiliated by refutation, they venture to dogmatize with all the arrogance and superciliousness of scholastics. Such a spirit in conducting a discussion will prove a Hudibrastic gun, which,

> "Whether aimed at duck or plover,
> Reacts and kicks the owner over."

A discussion must always be earnest, but at the same time calm and dispassionate, and conducted with the sole view of eliciting truth. If not so conducted it is a mere aimless wrangle about words of uncertain meaning, or even without meaning at all. It requires great caution to keep a discussion from degenerating into a mere wrangle.

We will repeat the rule to be observed in conducting a discussion. It is to set forth clearly and fully all the known facts of the subject, and assume nothing as true until verified. The foundation upon which to

base an argument must be the bed-rock of facts.

The universe is and always has been incessantly in motion. What is the cause of this motion? As before intimated, the motion must be the effect of one of the forces of Nature. The inquiry is to determine which one of the forms of natural energy it is, and to verify and demonstrate the conclusion. An impediment, however, must be first gotten rid of.

It has been assumed that gravitation is the cause of the motion exhibited in the universe, and it is claimed that Newton is the authority for the statement. This is conceding more to Newton than he ever claimed. The late eminent astronomer, John P. Nichol, of Glasgow, Scotland, in his "Cyclopedia of the Physical Sciences," says: "Previous to Newton's period the best cultivators of physics had gradually been growing accustomed to the fundamental idea of gravity. Whatever that force is, they saw it acting, and Galileo had determined the laws of its action on falling bodies, or of bodies near the surface of the earth. Long after, a more distinct idea of

*central forces* arose, or of forces drawing bodies towards certain immovable points or towards centers of other masses."

Newton, in one of his letters to his friend Bentley, says: "Gravity must be caused by an agent acting constantly, according to certain laws, but whether this agent be material or immaterial I leave to the consideration of my reader." Every one who has not abdicated his manhood and renounced his right to think for himself is therefore not scientifically heterodox if in the exercise of his own judgment he concludes that gravity is the effect of an immaterial agent, and that agent is electricity. Newton was not dogmatic. He says, "Hypotheses non fingo," or, to quote the whole in English, "I do not invent hypotheses; for whatever is not deduced from phenomena is an hypothesis; and hypotheses, either metaphysical or physical, or grounded on occult qualities, should not be allowed any room in philosophy."

In the letter from which I have already quoted he declares inferentially that he is undecided whether gravity is an original cause, or whether the effect merely of a material or

immaterial agent, which he leaves for decision to his reader. He adds: "That gravity should be innate, inherent, and essential to matter is to me so great an absurdity that I believe no man who has in philosophical matters a competent faculty of thinking can ever fall into it." This disposes of the theory of universal gravitation, which scholastics attribute to him. It certainly can not be universal if not innate, inherent, and essential.

Newton defines gravity to be "a simple attractive force exerted between any two or all particles or masses of matter at every sensible distance, but with strength varying inversely as the square of the distance." Scholastics have formulated this definition into the doctrine of universal gravitation; that is, "that the tendency of all matter in the universe is towards all other matter. Every body or portion of matter attracts and is attracted directly as its quantity of matter and inversely as the square of the distance from the attracting body."

Perspicacious minds have long since perceived the difficulties, indeed the impossibility of harmonizing this dogma of gravity

with the facts. They have hence endeavored to modify it. It is sufficient, whatever the dogma may say of the universality of gravitation to the contrary, that every planet is a center of attraction. For example, take Venus and the earth. Venus attracts all particles of matter within her influence, and the earth does so likewise with all particles that come within her influence. It is also obvious that the position of some matter may be such—the gases in space, for instance—as to be equally influenced by the earth and by Venus, and hence drawn or attracted to neither. Practically, such matter is not within the dominion of the universal gravity of scholastics, for it has no "tendency to all other matter," and especially not to that in its immediate vicinity, Venus and the earth.

Some scholastics, seeing the incongruity of the dogma with the facts, endeavored to avoid the fatal objection by dividing gravity into "planetary and extra-planetary spheres," which they call points of "central forces." But this, instead of making the idea more clear and palpable, involves it in greater obscurity by making it less distinct and more complex,

because, instead of one center, there are now an illimitable number of centers. Every star or sun and retinue of planets, according to the amended dogma, is made a center towards which matter tends.

Scholastics assume that gravity is one of the natural forces. What grounds are there for the assumption? If it be a natural force, then it must be amenable to the inexorable law that governs the natural forces. This law is that they are mutually convertible. But gravity is inconvertible into any other form force. All forms of force become expended in the performance of their functions in the economy of nature, but gravity does not diminish by action, but is increased manyfold, the force growing up within itself the more rapidly the more it is employed to produce effects.

In planetary motion schoolmen assume, for instance, that the moon's motion is in consequence of its falling towards the earth; of a planet, in consequence of its falling towards the sun, etc. According to this notion the moon and planets have been falling from the beginning of time, and have not yet attained

to the point whither under the influence of gravity they are tending, and gravity, the cause of the falling, has produced effects all the time without diminution of energy, and both will continue forever.

The notion is incomprehensible. It is known that planets occupy now the same distance from the sun they ever did, after a fall from all eternity. Hence they must, in the meantime, have been lifted up the same distance they fell. The problem hence is, if the moon every moment falls a certain distance towards the earth, there must be a force that pulls it at the same time away from the earth an equal distance, in order to give space to continue falling.

Newton lived nearly a century before Franklin identified lightning with electricity. Consequently he could not know that electricity was a natural force, and assign it a function in Nature. He discovered the law of attraction, which he called gravity, because it gives weight, to be that, under proper conditions, "bodies attract each other with a force directly as their mass, but inversely as the squares of the distance." He did not discover

that the law of repulsion was identical. Repulsion, however, was not unknown to him. He speaks of some substances as being social and of others as unsocial, some as having sympathy and of others as having antipathy towards each other. The fact was known to the Greek philosophers, who said that matter was affected with love and hatred, as between the sexes.

Hooke, the contemporary of Newton, in the observations he made on the comet of 1680, perceived that the tail of the comet was composed of matter streaming out from the nucleus on the opposite side from the sun. Gravity had assigned the sun as the center of attraction. But here was the fact in the tail of the comet, of matter flying off in the opposite direction. He hence inferred that there were two forces that produced motion—gravity producing weight and gravitation producing lightness; the first to cause matter to converge to a center, the other driving it from the center.

The love and hatred that subsisted between particles of matter—affinity when in opposite electric states, and aversion when in similar

states—observed by the Greeks, is what is now technically called positive and negative. They are realities, and hence undeniable. Whether the names that have been applied to them are appropriate is another thing. We know they exist, but of their nature, properties, and qualities we know nothing by which we can properly describe them. Exhaustive experiments upon the characteristic light of the two polarities have been made with Geisler's tubes by Dr. Robinson, of Armagh, and by Professor Plücker, of Bonn, and the light surrounding the positive pole is always found to be red, while that of the negative is blue. The effect of a discharge by a negative pole has also been found to differ from that of a positive. It is established that attraction and repulsion conform strictly to the law in every particular as attributed to gravity. Electricity—and, if you choose, magnetism—meets all the requirement exacted by nature from gravity, and consequently the latter is superfluous, and in Nature there is nothing superfluous. We are, therefore, warranted in rejecting it, and inferring that electricity is the motor of the universe. The motion of the sun through space

is one of the facts that needs to be accounted for. Can it be accounted for upon electric principles?

All bodies in space, whether suns, planets, or satellites, are negative. Space and the gases that fill it are positive. The dissimilar electric state of space and the bodies in it is, therefore, the cause of the motion of the sun, and consequently of that of its retinue of planets through space.

That area of space occupied by a solar system will tend to become negative—that is, similar to the bodies occupying it. Hence it becomes repulsive to the system repelling, and driving it out into an unoccupied space, which, being positive, at the same time attracts and pulls out the negative system. This pull at the system in front and shove in the rear is the cause of the motion.

The sun is the vivifier of the solar system, dispensing light to it. The light of the sun can not fall upon any thing without heating it, and nothing can be heated without starting electric currents from the points heating. According to the law of the transmutation of energy, it is the light that is converted into

heat, and the heat into electricity. The earth has—and consequently we are warranted to infer that all planets have—electric currents flowing around it from east to west. The effect of the electric current is to produce boreal magnetism around the point which it circulates in the Northern Hemisphere, and austral in the Southern Hemisphere. Every planet is hence a magnetic body—electro-magnet—as well as an electric body. It is known by experiment that a fixed magnet will whirl a free current of electricity around it, and a fixed current will do the same with a free magnet. Hence, upon electric principles the revolution of planets around suns is accounted for. Hence we get rid of the absurd dogma of a planet falling towards the sun while it is pulling itself exactly the same distance away.

I will not announce any cosmogony whatever, for the reason that neither the time when the universe was created, nor how, is known. We assume it was created; we know it stands, and that it will continue to stand upon principles now in operation. Can these principles be known or inferred from what is known to exist? These principles are immutable. They

are the same now that they ever were, and always will be. The solar system is a group of bodies separate and distinct from all other groups. Every member of the solar system is individually an integral part of the group. How do the members behave towards each other? How does the group as a unit behave towards other groups, and upon what principle is their behavior based?

Analogous facts are produced by suspending upon non-conducting fibers or threads a number of pith-balls. They will hang perpendicularly from the point of suspension, and touch each other. If they are now touched with a charged conductor, they fly asunder, and arrange themselves in a ring below the point of suspension, and remain so. If now one is pushed towards another, it avoids it as long as it has any freedom of movement. If a conductor more highly charged is introduced amongst the group, they separate still farther, if a feebler charged conductor, they approach closer; and if a conductor charged with the opposite electricity, they instantly collapse. The behavior of such groups of bodies is identical with that of the members of the solar

system. There is no doubt that their behavior is based upon electric principles. Why, then, should we hesitate to accept the dogma that electricity is the motor of the solar system, and consequently of the universe, when it satisfies all the necessary conditions of such motor?

Suppose the influence exerted upon the earth by the sun is so powerful as to drive—that is, repel—the earth ninety million miles from the sun. She takes her position at that distance because it is the equator between the attraction and repulsion of the sun. If an exterior body—Mars, for instance—forces the earth nearer to the sun, as soon as the influence of Mars is gone the sun will repel the earth outward again, and somewhat beyond the equator between attraction and repulsion. Supposing that Venus repels the earth beyond her orbit, she swings back, and oscillates to and fro till she finds her equilibrium again. The earth and all planets disturbed oscillate like the arms of a balance until the disturbance is expended. It was the oscillations of Uranus on its orbit from this cause that led to the discovery of Neptune.

I will not tackle the moon problem. The natural causes above spoken of explain, when properly applied, the behavior of "our erratic satellite," as Herschel calls it. It is not philosophical to attack a problem at its most intricate and complex points. It would never do to commence geometry with the forty-seventh problem of Euclid. The moon has so many inequalities, caused by the combined influence of the sun, the earth, and Venus, requiring equations, that it would never do to commence the study of the laws of celestial motion at such a complex point.

ST. LOUIS, Mo., July 5, 1883.